Project no. 727040

GIFT

Meaningful Personalization of Hybrid Virtual Museum Experiences Through Gifting and Appropriation

Horizon 2020

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Package and Release of the Final Toolbox

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PU	Public	**x**
CO	Confidential, only for members of the consortium (including the Commission Services)	
EU-RES	Classified Information: RESTREINT UE (Commission Decision 2005/444/EC)	
EU-CON	Classified Information: CONFIDENTIEL UE (Commission Decision 2005/444/EC)	
EU-SEC	Classified Information: SECRET UE (Commission Decision 2005/444/EC)	

Type

R	Document, report	
DEM	Demonstrator, pilot, prototype	**x**
DEC	Websites, patent filing, videos, etc.	
O	Other	
ETHICS	Ethics requirement	

Abstract

This deliverable presents the final release of the Gift toolbox which comprises 11 tools to enable museum curators, designers and other stakeholders to prototype digital experiences for visitors.

Three tools focus on prototyping visitor-centred mobile and social experiences to be delivered via visitors' own smartphones. *Gift* enables visitors to exchange personalised tours with others as gifts. *Never Let Me Go* enables pairs of visitors to play with the experience of controlling another's movement, behaviour and experience in a museum. *One Minute* enables visitors to scan objects so as to record and leave personal stories and hear others' stories too.

Four tools are concerned with different aspects of attaching digital assets to physical artefacts within museums. *Artcodes* enables people to create their own aesthetic scannable markers, attach digital media to these, and to share the resulting experiences with others. *Gift Wrapper* builds on this to support the 'digital wrapping' (and unwrapping) of physical artefacts using a combination of QRcode, NFC and Artcode technologies. *Scannerbox* offers a lightweight and inexpensive photogrammetry toolchain for capturing 3D models of physical artefacts. *VRtefacts* allows for the subsequent overlay of such models on top of physical props so as to create tactile virtual reality experiences.

The final three tools allow for the visual exploration of data captured from visitor experiences or design processes. *Cardographer* visualises data captured from the use of ideation cards, including the Visitor Box museum design deck, so as to help designers reflect on their thinking. *Emotion Mapper* visualises emotional response data captured from a mobile survey tools, including free text responses to prompts alongside self-reported emotional scores on recognised rating scales. *Gift Viz* visualises the data generated by the Gift tool mentioned earlier including how far visitors progress through the gifting experience, which exhibits they choose as gifts, and social patterns of giving and receiving.

These tools have been released in downloadable and/or online taster formats via the Gift website and their source code made available as open source.

The deliverable provides an overview of each tool and describes how it has been used in partner museums.

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Introduction

This report presents the final release of the Gift toolbox.

It builds on D6.3 that set out the direction our toolbox had taken since its preliminary 'Beta' release as reported in the earlier D6.1 and D6.2. This final deliverable in the series details the digital tools that have been released, including how they have been deployed in various museums. Consistent throughout the project has been the aim to create an open toolbox that enables museum and cultural heritage professionals to practically engage with a variety of digital tools to help them explore the design of new kinds of interactive experience.

We begin with an overview of our strategy for developing the toolbox, especially how the tools emerged from engagements with other workpackages and also from external partnerships that led to a pipeline of tool development. We then introduce each tool individually.

Previous versions of some of the tools have been introduced in previous deliverables (Gift, Artcodes, Scannerbox) and are summarised here again for completeness along with details of any further developments and/or new deployments. Several new tools emerged from our development pipeline during this last year of the project and are reported here for the first time (Never Let me Go, One Minute, VRtefacts and Gift Wrapper). Three further tools have emerged from early explorations of developing visualisations to assist museum designers, curators and other stakeholders (Cardographer, Emotional Mapper and Gift Viz). These represent relatively early, but we think promising, work that has become possible towards the end of the project as data became available from use of other tools and deployments of experiences in partner museums.

Strategy

Deliverable D6.1previously set out our overall strategy for the toolbox. To recap, we envisaged a collection of useful tools that would address different aspects of the process of designing, implementing and evaluating an interactive museum experience. Our idea was that these could be used as standalone or potentially loosely knit together through the use of a common format for data interchange – the schema – with the further possibility of using a common Content Management System when appropriate. This was very much in contrast to the idea of developing a monolithic tool that might be overly complex to engineer and challenging for museums to learn. Rather, our aim was to provide multiple, easy points of entry into the Toolbox that museums could quickly try out and then delve deeper after that.

The second important aspect of our strategy was the process by which the tools were developed. Here we adopted an iterative approach. Rather than starting with the tools before then experiences in the other workpackages (most notable WP2 and WP3) or starting with the demonstrators and then abstracting the tools from this later on, we followed both approaches in parallel. Some of our tools originated within WP6 with other workpackages then being encouraged to use them. Others emerged as generalisations from ideas and specific solutions that originated in the demonstrator workpackages and were then generalised in WP6. Moreover, the users/originators of the tools may be internal to the project (WP2, WP3 and WP4) or external (via ARM and even other partners). This relationship between tool development and use was summarised in the first year by **Error! Reference source not found.**(taken from D6.1).

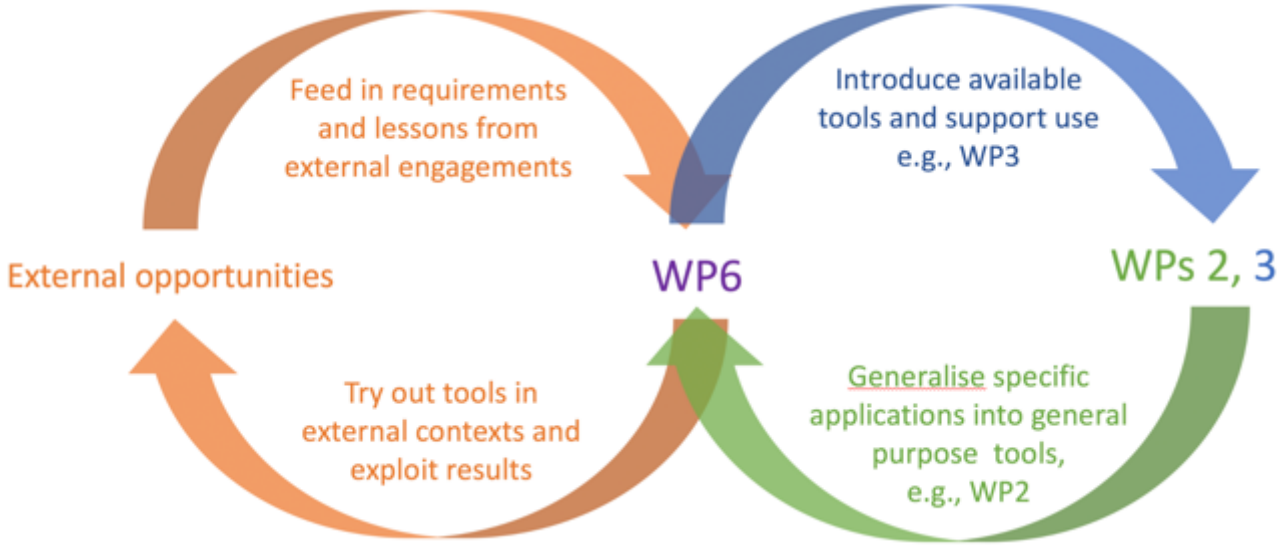

Figure 1. Initial iterative relationship between tool development and use (from D6.1)

This relationship has evolved further since then through further iterations. **Error! Reference source not found.** shows the evolving relationship to WP2 (Blast Theory's Gifting experience). Blast Theory developed a second iteration of the gifting experience for Brighton Museum and art Gallery which was then generalised into a final released prototyping tool for WP6. This work also led to a further (and initially unanticipated) deployment at the Munch museum and interest from other external museums. In turn, WP6 developed a series of visualisations to help evaluate the approach as deployed in museums which have fed back into WP2.

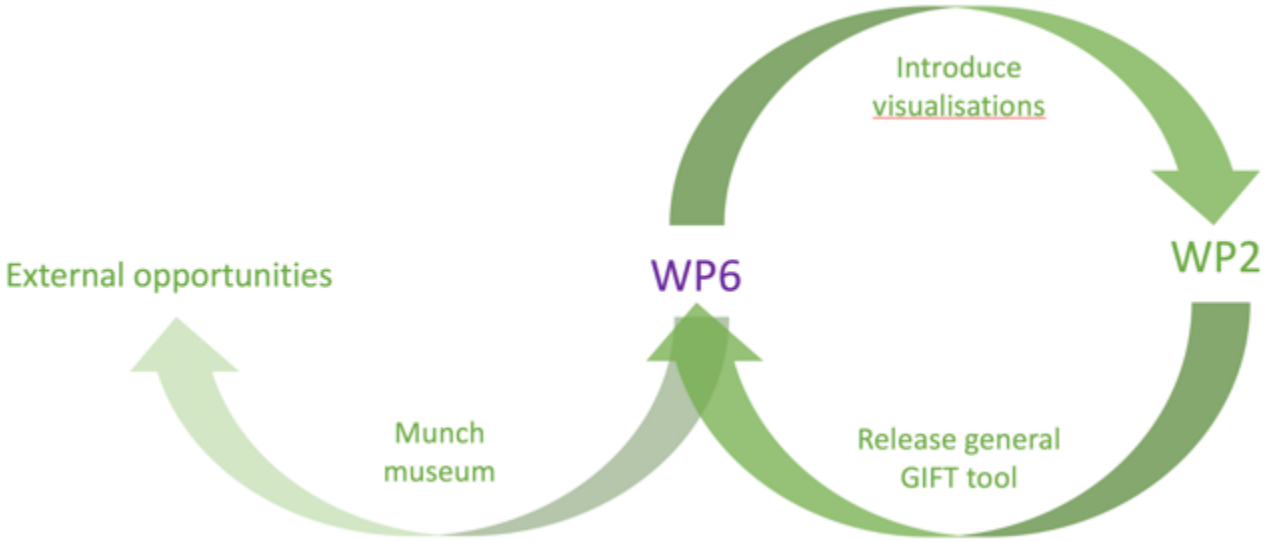

Figure 2. Further iterations with WP2

While also iterative, the relationship with WP3 has worked differently from that with WP2. The work in WP3 has been stimulated by trying out series of tools that have been fed in from WP6. Here the first generation of tools introduced from WP6 into WP3 (Artcodes and ScannerBox) were subsequently used by external museums, most notably in a commercial project at the Serbian National Museum. At the same time, WP3 itself undertook a change of direction, choosing to focus on emotionally sensitive experiences in its second iteration. In response, WP6 introduced several further tools into WP3 (Panopticon and BlueMax) that were tried out as part of a series of experiments. In turn, WP3 generated the first prototype emotion self-reporting experience that then fed back into and was generalised into the Emotion Mapper tool WP6.

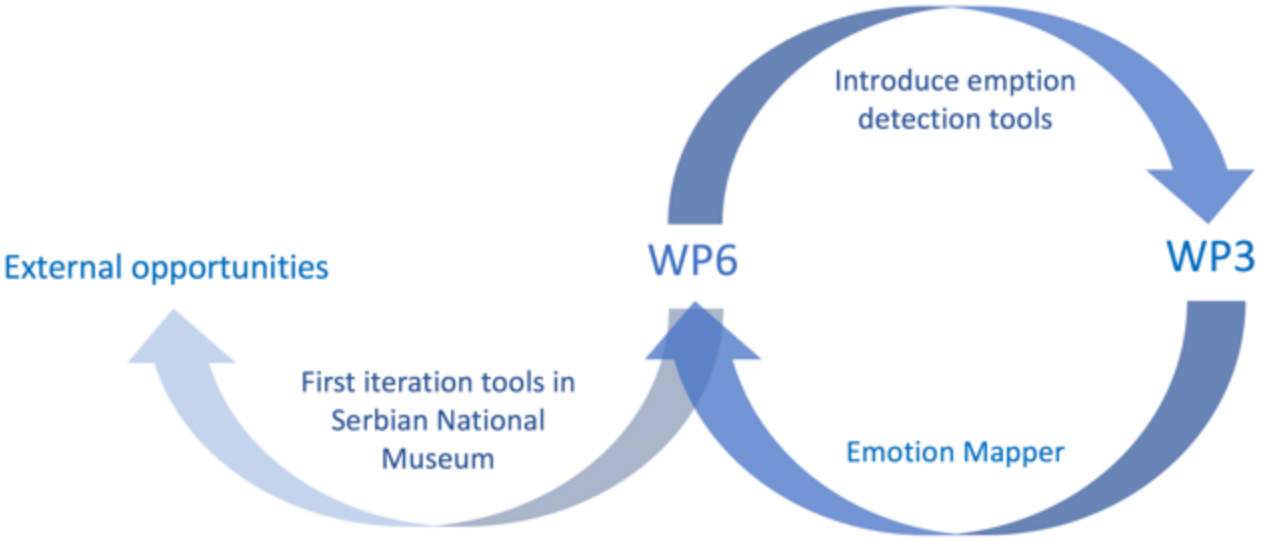

Figure 3. Further iterations with WP3

In short there have been deep connections between workpackages in the project with WP6 fulfilling the dual roles of (i) supporting other WPs in their practical work and (ii) seeking to generate general tools for external use (and support external partners in using these).

The above processes effectively established a pipeline for tool development, with new tools being borne all the way through the project. Some tools (e.g., Artcodes) have been around since the start

of the project and widely applied throughout, while others such as the various visualisation tools introduced later on, emerged in response to the need for data-driven reflection right at the end of the project.

Beyond clarifying our general approach, this pipeline above explains why we have a variety of tools in the Toolbox with different statuses in terms of their maturity, validation, robustness and availability. The tools presented below range from being publicly released, tried and tested tools that have been used in multiple museums at one extreme, to early prototypes that are available by contacting the relevant GIFT partner to explore how they could be integrated into a future project at the other.

Overview of the final toolbox

The Gift Tools are aimed at technical and non-technical parties alike. The ultimate aims of releasing design, implementation and evaluation tools are to:

- Support digital champions within museums in undertaking practice-led research and design *before commissioning or* developing an interactive museum experience.
- Further support them in the evaluation stage *after* development.
- Offer non-technical parties the opportunity to carry out any or all of the design, implementation and evaluation of gifting experiences *without* resorting to bringing in developers.

Introductions to the Tools are accessed via the Tools section of the public toolbox website. **Error! Reference source not found.** summarises the contents of the final toolbox.

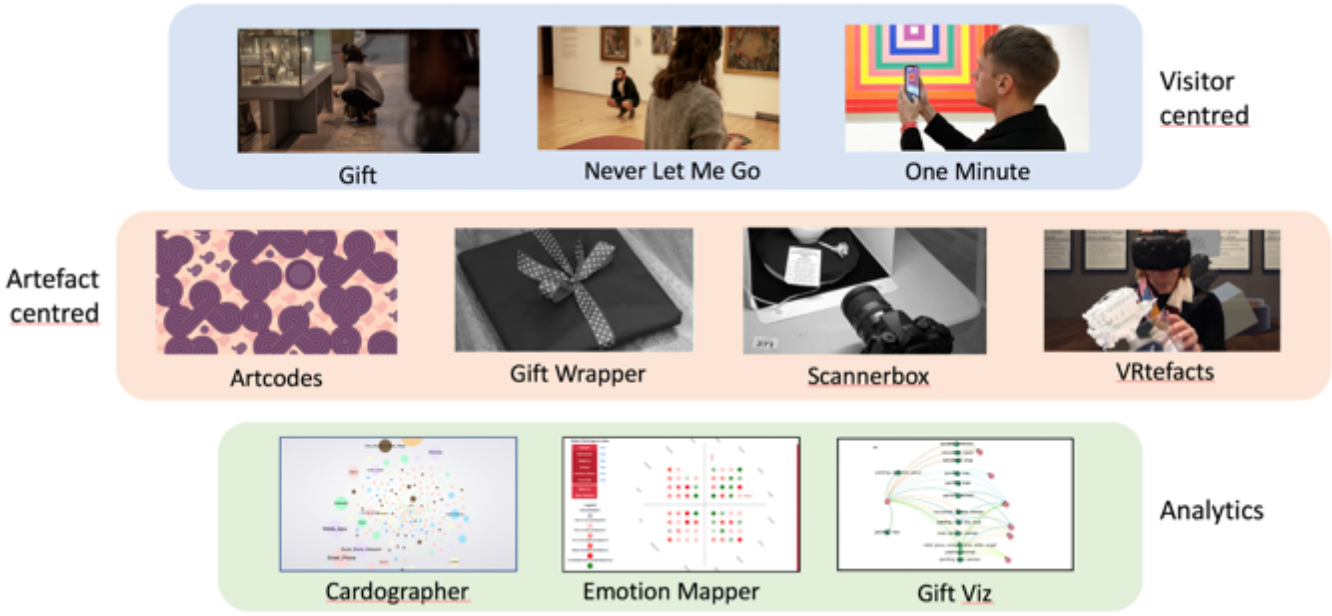

Figure 4. Overview of the final Gift toolbox

Three tools that enable the prototyping of visitor-centred mobile experiences in museums. **Gift** enables visitors to make personal tours as museum gifts for one another. **Never Let Me Go** enables pairs of visitors to engage in lightweight games of controlling one another in a museum; while **One Minute** allows stories to be attached to exhibits that can be triggered using image recognition. All three of these tools are released tools.

Four tools that enable digital materials to be connected to physical artefacts. **Artcodes** allows people to create their own visually aesthetic markers, attach personal layers of digital content to these and share them with others. **Gift Wrapper** extends this idea to support the digital gift-wrapping and unwrapping of physical items through the use of Artcodes, QR codes or NFC tags. **Scanner Box** is a cheap and lightweight but effective photogrammetry tool chain to capture 3D models of physical artefacts. **VRtefacts** is a 'superimposed' virtual reality tool for overlaying 3D models onto corresponding props to deliver visual-tactile experiences. Artcodes and ScannerBox are released tools while Gift Wrapper and VRtefacts are prototype tools.

Three further tools help people explore the potential for visualising the data generated by other tools as part of the evaluation of museum experiences**. Emotion Mapper** is a tool to enable visitors to self-report their emotional responses which can then be visualised. **Gift Viz** visualises the social-network relationships between givers, receivers and gift items generated by gift exchanges. **Cardographer** visualises the use of the Visitor Box ideation cars (a method from WP4) so that museum experience designers can reflect in their design thinking. All three of these have the status of prototype tools.

This final version of the Toolbox presents a range of offers for museum professionals, either as downloadable software for them to use directly or as a list of instructions and services (e.g., Scanner Box and Cardographer) that they can follow to achieve results that directly address the physicality of their collections. This approach not only expands the number of high-value tools that we can provide, but it opens up a range of ways for museum professionals to engage with increasingly affordable, accessible, and even (among some visitor bases) expected technologies such as 3D scanning and printing, Virtual Reality, and more. All parts of the final release of the toolbox can be accessed at https://gifting.digital.

The following table summarises the tools available in the final version of the toolbox. Subsequent sections present each of the tools in turn.

Tool	**Status**	**Availability**	**Deployed at**
GIFT	Publicly released production tool & open source	Web app	Brighton Museum and Art gallery, Munch Museum
Never Let Me Go	Prototype tool (contact ITU)	Android app	
One Minute	Prototype tool (contact ITU)	Android app	
Artcodes	Publicly released production tool & open source	Android and iOS app	National Museum of Serbia, Tate, Museum of Yugoslavia, Nenescape, Lakeside Arts, National Videogame Arcade
Gift wrapper	Public release protoyping tool o& pen source	Android app	
Scanner Box	Publicly released production tool & open source	Documented toolchain	
VRtefacts	Prototype tool available through UoN		Derby Silk Mill Museum
Cardographer	Prototype tool available through UoN	Example interactive visualisation online	Uses data captured from XXX
Emotion Mapper	Prototype tool available through UoN	Example interactive visualisation online	Uses data captured from the Munch Museum
Gift Viz	Prototype tool available through UoN	Example interactive visualisation online	Uses data captured from Brighton Museum and Art gallery, Munch Museum

Gift

Gift is a Web app that enables visitors to create mini-museum tours as gifts for others.

Status
The Gift app tool is a fully functional publicly released tool, freely available as a Web app designed for a variety of phones and tablets. The tool was exclusively developed from scratch during the project. We are committed to maintaining this tool and providing it for free until the end of 2021. You may also install the service on your own servers. Blast Theory will also provide support until at least the end of 2021 for anyone who chooses one of their paid options.

Description
With Gift you use your smartphone or tablet to create a digital gift. It's like a playlist or a mixtape, except with objects from a museum. Some people create playful treasure hunts with a game-like mission to find the objects, while others spend a great deal of time and care choosing, photographing, and describing a single object. The Gift app is designed to be as seamless as possible: once visitors navigate to the website name of your choice in their phone's browser (like 'thegift.app'), they can start exploring and creating gifts straight away. The app in its most basic version can be built upon and customised by accessing the code repository[1]. Alternatively, Blast Theory can provide two levels of service to customise the app for your institution. They provide a full explanation in this information pack[2]. A walk-though and detailed description of the tool can be found in companion Deliverable D2.6

Deployment: Gift app at Brighton Museum & Art Gallery

Over the last 3 years, Blast Theory have developed an app that invites a visitor to see the museum through the eyes of someone else – a person they want to create a digital gift for. Their partner institution for this development was the Brighton Museum and Art Gallery[3], a city museum housing a wide range of artefact types from the local environs and around the world.

Brighton Museum's curators wanted above all to build visitor engagement that did not detract from the objects on display. Therefore, Blast Theory's app centred on voice – visitors listened more than looked, and spoke directly into their phones. The very personal tone and style immediately set the expectation for a reflective, thoughtful visit, and visitors could take as much time as they liked.

The app first offered visitors a gift of their own to open, created by museum staff. The gift gave visitors a context for what would be expected of them and what a gift could offer.

Once a visitor chose to make a gift, the app asked them to mentally select the person they would make their gift for before exploring the museum. It then asked them to select an object they thought would be particularly interesting to their receiver, take a picture from their own perspective, and record a personal message in their own voice. Visitors could include up to three objects in one gift, which they sent using one of several popular online sending and sharing services. In the spirit of a personal gift, though, the gift went only to its receiver, not to a social media platform.

The app was developed iteratively through a series of workshops and user tests at Brighton Museum from early 2017. In July 2018 Blast Theory organised a large public trial lasting three days, during which 170 visitors tried out the app. We gathered feedback through interviews and questionnaires, allowing us to conduct a thorough analysis of the user experience. The final version was publicly available from early June through late September 2019. (The 2018 version discussed in the research

paper differed slightly from this final version and is the topic of this research paper:
Jocelyn Spence, Benjamin Bedwell, Michelle Coleman, Steve Benford, Boriana N. Koleva, Matt Adams, Ju Row Farr, Nick Tandavanitj, and Anders Sundnes Løvlie. 2019. Seeing with New Eyes: Designing for In-the-Wild Museum Gifting. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI '19). ACM, New York, NY, USA, Paper 5, 13 pages. DOI: https://doi.org/10.1145/3290605.3300235

Deployment: Gift app at Munch Museum

The Munch Museum[4] in Oslo, Norway, posed a very different situation for Blast Theory to deal with. It offers artworks by a single artist rather than the collection of artefact types at the Brighton Museum and Art Gallery[5]. Therefore, terms like 'object' had to be changed for terms more specific to visual arts, and playfulness was perhaps less appropriate for the painter of the famous 'Scream'!

These and many other concerns led Blast Theory to radically alter and shorten the narrative within the app, although the functionality remained fundamentally the same as the final version released in 2019 at the Brighton Museum[6].

The Munch Museum also opted for a different means of promoting the app to the public. They listed the app as a free option on their main list of ticket items. The only other push for uptake was some signage and a set of regular colour postcards explaining the app's proposition. There was no front-of-house effort to encourage its use, and staff were not expected to take an active role.

However, as with the use case in Brighton, the visitor experience with the app began with the option to open a gift from the museum. This gave them a context for what would be expected of them and what a gift could offer.

The app is live at the Munch Museum from 28 September 2019 – April 2020. It has had substantial uptake already and has not caused significant problems for the museum's staff or curators. At the time of this project's close, no more detailed information on the app's uptake or response to it is available.

1. https://gitlab.com/blasttheory/gift
2. https://gifting.digital/wp-content/uploads/2019/08/gift-information-pack.pdf
3. https://brightonmuseums.org.uk/brighton/
4. https://munchmuseet.no/
5. https://brightonmuseums.org.uk/brighton/
6. https://gifting.digital/gift-experience-brighton-museum/

Never Let Me Go

"Never let me go"[1] is a play experience for art museums. With "Never Let Me Go", two visitors guide each other's encounters with art. Through questions and prompts, the visitors can affect each other's relationship with the present artwork and the experience fosters deep introspection in a playful way.

Status
"Never Let Me Go" is currently in a prototype state and can be deployed by contacting the GIFT support team.

"Never Let Me Go" is currently an experimental prototype that is released with the intention of inspiring further engagement and development. Information about 'Never let me go' and how it can be implemented at your museum can be found on the GIFT website.

Description
"Never let me go" is a two-person experience. In practice as they enter the exhibition, both visitors open the "Never let me go" web app on their mobile phone. One person inputs the code that appears on the other person's phone, into their own phone – this connects the two individuals through the app, and the experience begins. The experience is divided by the 2 different perspectives of the two participants – the controller and the avatar. In the case of the controller, the interface presents 6 categories, each with a different selection of commands, questions, or suggestions. Each time the controller picks one, the corresponding sound plays on the avatar's headphones.

"Never let me go" is intended to be experienced in art museums. It is a playful experience that is designed to happen in an environment that is normally not meant for play – a traditional art museum. This allows play to act as an excuse for participants to behave differently, and explore different perspectives during their museum visit. The experience acts as an audio guide, where both participants guide each other through their different perspectives, creating a social and simultaneously introspective experience.

[1] https://gifting.digital/never-let-me-go/

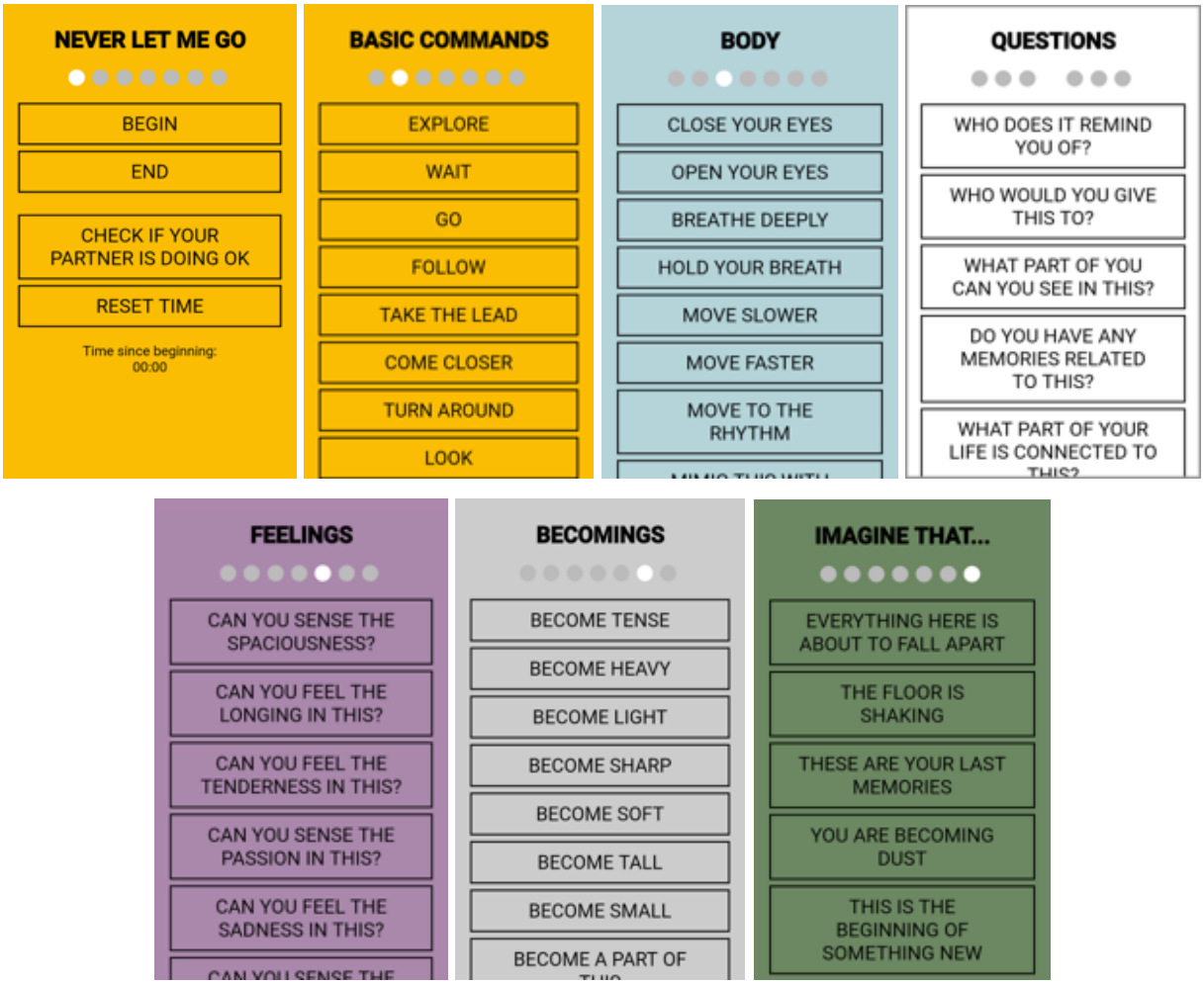

Figure 5: The menus in the web app

Deployment: National Gallery of Denmark

The main trial of "Never let me go" took place at the National Gallery of Denmark. 22 people from 14 different nationalities were recruited through social media and a mailing list for people interested in cultural events in the Copenhagen area.

Each test was separated into four different sessions, approximately 10 minutes long. After a session ended, the participants would swap roles. Thus, they would try out both the Avatar role and the Controller role twice each, allowing us to observe how they progressed in their use of it. Before they started, they were given a mobile device and a set of over-ear headphones. They could choose where in the museum to start the experience. Most often this would be in the modern art section of the museum, perhaps because this was the section which most of the participants were interested in seeing. The Controllers were instructed to press 'Begin' when they felt ready to start.

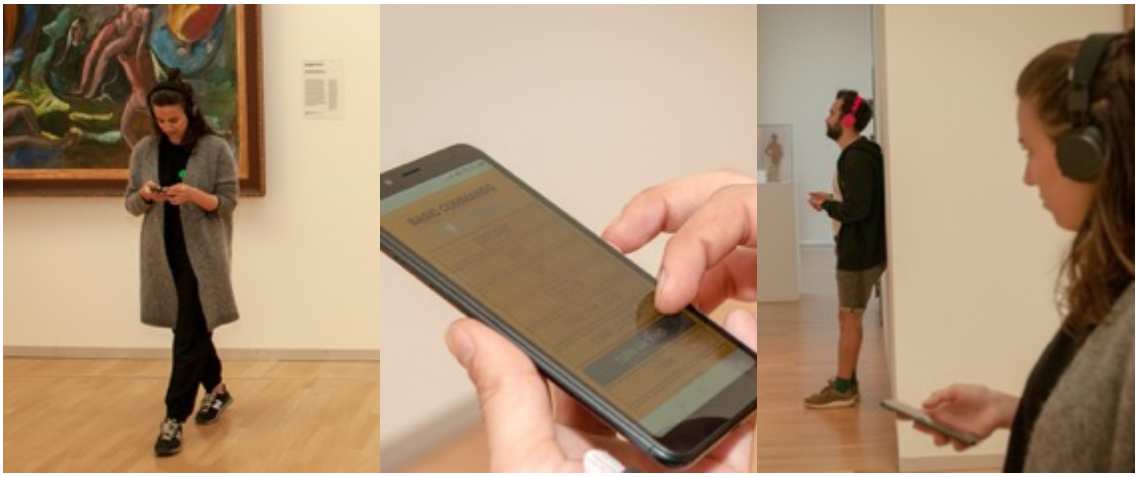

Figure 6: Play tests in the National Gallery of Denmark

Brian Eno's ambient soundtrack: 'Music for Airports' was used as background music during half of the test sessions. The intention was to compare having silence with having relaxing music that wouldn't interfere with, or colour, the experience too much.

The results from this study showed that when people were allowed to play in an art museum humour was definitely an important part of it, but serious moments of introspection, reflection and emotional engagement were just as present. What the players valued mostly was the distinctly personal approach to the art, especially in combination with the ability to have a special connection to their partners. This gave them the possibility both to gain new perspectives of the artwork but also to get to know their partners better.

One Minute

One Minute[1] uses image recognition to identify artworks in the museum and offer visitors short, bite-size reflections about them. It consists of two parts:

- A mobile app[2] that allows visitors to scan works of art and read interpretive texts in the form of engaging, bite-sized stories.
- A back-end story-editor tool[3] that allows curators to easily construct and edit interpretive texts, with guidelines on how to create engaging, brief texts.

Status

In collaboration with Brighton Museum and Art Gallery, we have designed, developed and tested the One Minute mobile app and story editor tool, with plans for public deployment for museum visitors in 2020. A demonstrator version of the One Minute mobile app – a version designed to work with selected objects from Brighton Museum – is available for download on iOS[3] and Android.[4] A version of the story editor tool has also been deployed as a web application.[4]

Both of these tools are open source,[5][6] and can be adopted or adapted for any museum. While we have provided source code and documentation, museums need to install and deploy the tools. This can be done by a single IT professional with a small time investment. The tools present a very generalist perspective on how a user may create or interpret short stories within a museum: therefore, museums are free to use these tools as they are, or can modify the dialogue and prompting to suit the needs of their organisation.

Description

The Visitor Experience

Once visitors download the mobile app, they can 'scan' artworks with their camera. The app uses image recognition to identify the scanned artwork, so no QR codes or external beacons are required. Once a user scans an artwork, a short story is presented (Figure 7).

[1] https://gifting.digital/one-minute-experience/
[2] https://apps.apple.com/us/app/one-minute-experience/id1485283829?ls=1
[3] https://modgift.itu.dk/one-minute/
[4] https://play.google.com/store/apps/details?id=dk.itu.oneminute
[5] https://github.com/twray/One-Minute-Experience-Mobile-App
[6] https://github.com/twray/One-Minute-Experience-Story-Editor

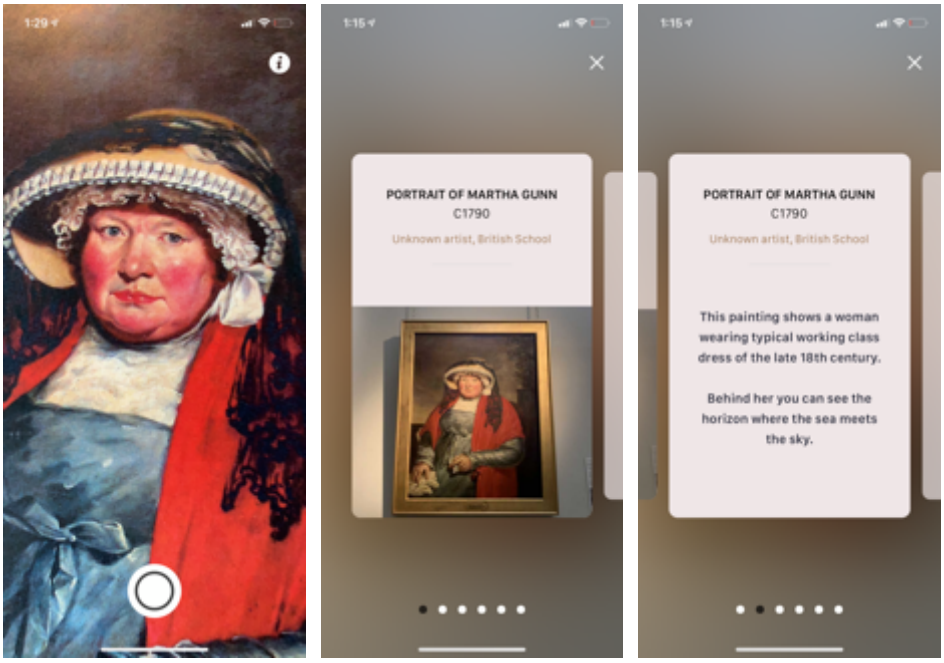

Figure 7. Screenshots from the One Minute mobile app: scanning an artwork and reading a story.

These short stories are divided among six screens of text, with each screen being approximately 160 characters long. The stories follow a classic Aristotelian storytelling structure, and users can swipe back and forth through each screen. The division of texts into several screens facilitates natural breaks in the reading, allowing visitors to pause and reflect on the details of the artwork, and direct their attention back and forth between the text and the artwork (Figure 8).

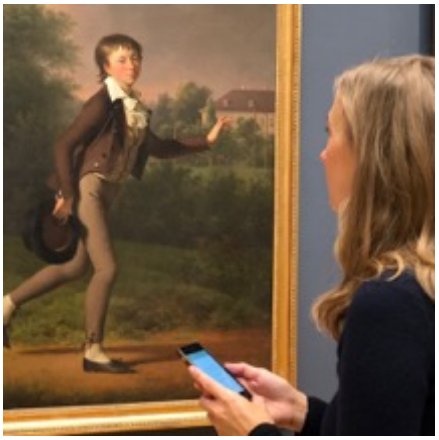

Figure 8. The storytelling format of One Minute encourages visitors to observe the details in the artwork.

The Story Editor

Stories can be created and edited using the story editor tool. After uploading a photo and providing some basic information about an artwork, users follow prompts that allow them to observe an artwork and create a simple, short story. The tool contains a set of guidelines and examples of what to write for each screen.

A specific storytelling format was devised that encourages users to observe the artwork, look for specific details, and promote curiosity. Whereas traditional museum labels rely on curatorial knowledge, these prompts are designed to elicit personal insights from the artworks.

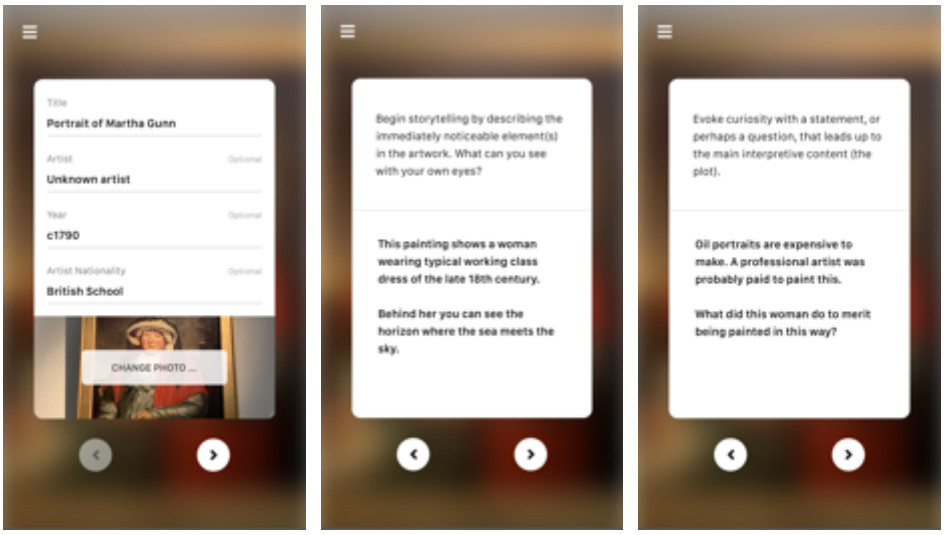

Figure 9. Screenshots from the story editor tool.

Deployment: One Minute at Brighton Museum and Art Gallery

One Minute was trialled at Brighton Museum and Art Gallery. Two story creation workshops were held, were curators, museum staff and local members of the community were encouraged to walk around the museum, find artworks and write short stories about them.

From these workshops, 24 stories were created, each referring to a specific object within the museum. These objects were widely distributed throughout both floors of the museum. From these stories, an exhibition guide was created that encouraged visitors to download the One Minute visitor app, find these objects, and read their stories.

The following day, a trial of the visitor app took place, where visitors were encouraged by members of the project team, front-of-house staff and public signage to try the One Minute visitor app. A total of 40 visitors tried the app, and they were given an exhibition guide that indicated the locations of the artworks. Visitors on average scanned between 5 – 6 artworks, with a median dwell time of 44 seconds.

Based on the feedback of these trials, there are plans to further develop and deploy the One Minute app at Brighton Museum in 2020. As part of this, we are exploring the possibility to reimplement the app as a web application. This is due to insights from our testing, that indicates a number of UX challenges that visitors face when they attempt to download and install a native app on their phones within a museum setting, as well as technological developments that make image recognition in a web application increasingly feasible. One Minute may also undergoing other minor changes in relation to feedback from the deployment at Brighton Museum

Artcodes

Artcodes enables people to design their own aesthetic visual markers that can be recognised by a mobile device, attach layers of content to collections of such markers, and share the resulting interactive experiences with others.

Status

Artcodes[1] is a fully functional, publicly released tool, available as a freely downloadable app on both iTunes[2] and Google Play[3] while the source code is available in Github[4]. Early versions of the app pre-dated the project, but the app has been refined as a result of use in the project, especially the flexibility with which new experience mappings can be composed.

Description

Artcodes is an extremely adaptable visual marker technology (like an optical label such as a barcode or QR code but hand designed). Anyone can easily learn how to create their own Artcodes, and the associated software lets a given code point to any digital asset, such as a web page, image, sound file, or video. As their name implies, Artcodes are visual images that look like 'art' and therefore can be designed to fit any theme, style, or historical period. They can integrate discreetly into a background or be the focus of attention.

The Artcodes app allows people to register an account after which they can create and share Artcodes experiences with others. This involves creating mappings between a collection of scannable Artcode labels and digital content in the form of external websites. The resulting experiences (a mapping between selected Artcodes and content) can then be shared with other registered users. Users can also open up, edit and reshare others mappings. This makes Artcodes a flexible tool for prototyping end-to-end experiences without the need for software development.

Deployment: Tate Modern

In 2017, artist Clare Twomey transformed Tate Exchange, a programme space at the Tate Modern museum in London into a factory making everyday objects from clay to explore ideas around the concept of production[5]. A 30-metre production line, forty factory staff, eight tonnes of clay, a wall of drying racks, and over 2,000 fired clay objects occupied the floor of Tate Exchange. Visitors could clock in, join the production line, and learn the skills of working with clay. They could exchange what they made that day for another person's tea pot, jug or flower from the factory – to take home and keep. To enable this exchange, Artcodes featured throughout the factory. When visitors arrived, they received a clocking-in card with an Artcode unique to each visitor. (Over 2000 variations of the image were made with the support of software). Other Artcodes were placed at each section to allow visitors to clock into each station they participated at. The Factory exhibit had a corresponding Factory smartphone app that visitors could use to log their progress through the factory and track where in the world the objects end up.

[1] https://www.artcodes.co.uk/
[2] https://apps.apple.com/us/app/artcodes/id703429621
[3] https://play.google.com/store/apps/details?id=uk.ac.horizon.aestheticodes
[4] https://github.com/horizon-institute/artcodes-android
[5] https://www.tate.org.uk/whats-on/tate-modern/tate-exchange/workshop/factory

Deployment: Nenescape

The University of Nottingham was approached by the Nenescape Landscape Partnership Scheme, a UK Heritage Lottery Funded project that is working to regenerate a section of the River Nene in the Rushden area of Northamptonshire, UK. To promote awareness of local history and heritage, we worked with project partners and local artist Michelle Barnett to develop the *All Aboard for Rushden* app[1], available for Android[2] and for iOS[3] devices

Barnett's artwork, produced as rugged, metal signs placed along the Greenway, is actually Artcodes in action. The design is based on the ties between current and past uses of the Greenway, showing cyclists and pedestrians (the current user groups) passing a signal box (indicating the Greenway's earlier use as a railway line). Visitors walk the interactive art trail and scan each artwork with their app. This unlocks the hidden histories of the area its people.

The app's content is based on a true local news story from 1911 in which a mail bag was hit by an oncoming train – on the same train line, not far from the art trail – and the porter nearly killed. The mail in that bag was eventually recovered. Visitors are asked to help find the letters. Scanning each artwork produced by Barnett reveals a different hidden piece of local history that may otherwise have been forgotten.

Figure 10. Five Variations of the trail Artcodes

An extra benefit of Artcodes in this project is that partners can create new content of any kind as often as they like, even soliciting stories from local residents or visitors. The council can create themes or games based on local events, times of year, or themes, as when visitors who completed the interactive trail during its inaugural festival were eligible for a prize. The council can also move the physical artworks or make more to extend the route, including new digital content.

[1] https://nenescape.org/news-and-features/allaboardforushden
[2] https://apps.apple.com/gb/app/all-aboard-for-rushden/id1433967509
[3] https://play.google.com/store/apps/details?id=uk.ac.horizon.artcodes.nenescape

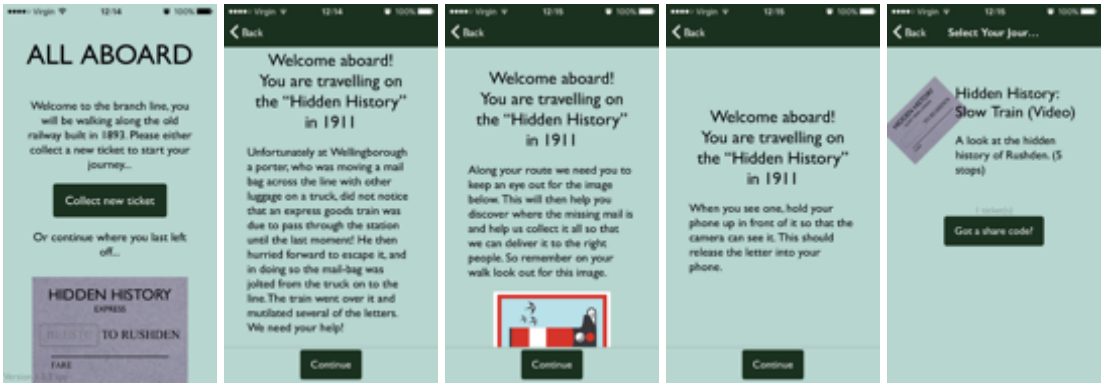

Figure 11. Screenshots of the experience introduction in the App

Figure 12. (Left) The app in action
(Centre) Alison Brand-Barker, Interpretation & Community Engagement Officer, River Nene Regional Park
(Right) Alison being interviewed by BBC Radio Northampton's Helen Blaby

An initial version of the app was tested with project stakeholders using prototypes of the artwork on 6 September 2018 in the Rushden Transport Museum. Following their feedback, the app was further refined and new content was added. The app was released for both Android and iOS devices as of 28 August 2019 – search for 'All Aboard for Rushden'. It was publicly launched as part of the Nene Valley Festival from 14-22 September 2019 and has been heralded by project partners as a successful element of their festival.

Gift Wrapper

Gift Wrapper enables gift givers to wrap physical artefacts in layers of digital media (analogous to physical wrapping paper) using a choice of three tagging technologies (QR codes, NFC tags or Artcodes) and share a link to the wrapping with others. Receivers can unwrap the artefacts by scanning it using a mobile device at which point the media is played back.

Status
Gift Wrapper is a prototype tool that emerged in the later stages of the project in response to the idea of 'digital gift wrap'. It combines elements of the gift exchange workflow from the Gift tool with the capability to attach digital media to physical using Artcodes (as above), but also extended to include the more mainstream and widely available QRcodes and NFC technologies. The tool is freely available for Android devices running 4.4 or higher from the Google Play Store. The Apple iOS version is under development. The source code is freely available on GitHub[1].

Description
With the Gift Wrapper app, visitors link a physical object with digital content to give to friends. Gift Wrapper is an app that lets your visitors create hybrid physical-digital gifts: gifts with both a physical and digital component. As we have shown with the Gift app, even the simple act of giving a friend a voice message alongside a photo of a museum object creates a more personal, engaging experience. With the Gift Wrapper app, visitors can create or select any digital content and link it to objects you sell in your gift shop. The app makes linking digital to physical a quick, easy process using a number of technologies depending on your museum's needs.

The app connects digital content to your institution using any or all of these:

1. QR Codes – square 2D bar codes that can be read by a device's camera.
2. NFC tags – microchips that can communicate wirelessly over short distances.
3. Artcodes[2] – artistically designed patterns that can be scanned by a device's camera using the app.

You decide which gifts to sell with codes and/or tags. Visitors will add their own digital content to these items. They could be products representing popular items in your collection, postcards, or even 3D prints of items in your collection (see VRtefacts[3]) or ones brought in by your visitors (see ScannerBox[4]).

There is no single visitor experience with Gift Wrapper. A lot depends on the physical object, which your cultural heritage institution will determine. A lot depends on the type of connection being used: in the case of cards, NFC tags tended to be placed inside the cards and used to play accompanying music, while hand-drawn Artcodes tended to take pride of place on the front and/or inside the card and to contain more primary content. QR codes (which are necessarily pre-printed) tended to be placed on the back and to be restricted to instructions or information on where the card came from. Early indications show a positive response and substantial engagement in the process.

[1] https://github.com/horizon-institute/hybrid-gifting
[2] https://artcodes.co.uk/
[3] https://vrtefacts.org/
[4] http://www.mixedrealitystorytelling.net/scannerbox-overview-and-workflow/

Figure 13. Christmas cards 'wrapped' with digital content through Gift Wrapper

You can mix and match obvious and easily identifiable codes, like QR codes, with hidden NFC tags or beautifully embedded Artcodes to create a playful set of interactions appealing to a wide range of ages and interests – or you can go with a single type of code. A customised version of the app allows you to offer your museum's own digital content in addition to the content made or chosen by your visitors (see below). With support for images and web content, visitors can send any internet-hosted digital media, from photos taken on the spot to webpages, videos, games, etc. Visitors are not limited to one piece or type of media per gift; for example, entire photo albums can be included.

Using Gift Wrapper gets your visitors to personalise their museum visit and share it with someone else. It makes them see your museum from a very personal point of view, which can be exciting and thought-provoking, especially when they are creatively working to make a gift for someone they know and care about. It also has the potential to increase sales and therefore revenue.

Gift Wrapper not only provides a uniquely engaging visitor experience – it can also introduce your museum to new audiences, even ones without the skills or interest to download and learn a new app. QR codes and NFC tags link to a web-enabled version of the app that allows anyone with web access to receive the same digital content as app-users. Even regular visitors who receive a Gift Wrapper gift will gain a new perspective on your museum through their engagement with the digital layer chosen uniquely for them.

To get started:

1. Decide your combination of QR codes, NFC tags, and/or Artcodes and the items you want to link them to.
2. Go to artcodes.co.uk/hg to generate QR codes and/or NFC tags, or artcodes.co.uk to learn how to make and use Artcodes.
3. Promote sales of objects that use the Gift Wrapper app.

Museums (or any interested cultural heritage institution) will need to provide stable wi-fi, or at least 3G or 4G coverage, for visitors to create their gifts in the museum. However, owners of a Gift Wrapper-enabled object can create their digital layers at any time and in any location.

It is always possible that visitors may make objectionable content associated with your museum that is publicly disseminated, by either the giver or the receiver – though this is unavoidable whether or not this app is used. Your institution will also want to take into consideration the needs of users who

do not have smartphones or tablets, those whose devices are too old to handle the app's functionality, and those who for any number of reasons find such devices difficult or impossible to use.

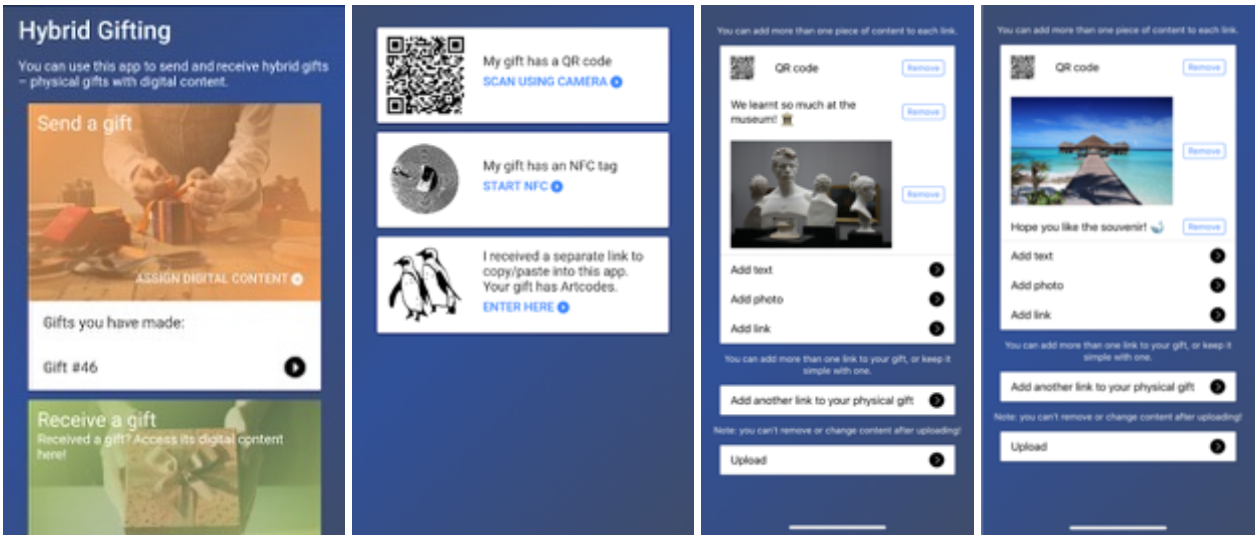

Figure 14. The prototype interface for the Gift Wrapper application

Deployment: Debbie Bryan

Gift Wrapper was used at a workshop with Debbie Bryan[1], an independent creative retailer and 'haven of gift giving' in Nottingham, UK. The workshop was geared towards making greeting cards and/or wedding favours. Its 11 participants were shown how to use and/or create QR codes, NFC tags, and Artcodes, then used the Gift Wrapper app to link the digital content of their choice to their cards. A subsequent workshop at the Mixed reality Lab involved 17 participants making interactive Christmas cards. The two workshops yielded interesting observations about the relationship between physical and digital layers in a single gift. The digital layer tended to be more highly personalised, using photos, songs, even secret messages. It was more interactive, turning some physical cards into games and jokes. Physical cards with digital layers tended to be seen as keepsakes more often than plain physical cards were, and participants tended to reuse the digital layer in a way that is difficult or impossible for physical objects.

Based on this work, The University of Nottingham has received significant follow-on funding to advance the Gift Wrapper app and explore the idea of *Hybrid Gifting* more fully. You can follow this work via the Mixed Reality Lab's project page[2] (*Hybrid Gifting* project details available early 2020).

[1] https://debbiebryan.co.uk/
[2] https://www.nottingham.ac.uk/research/groups/mixedrealitylab/projects/projects.aspx

ScannerBox

ScannerBox is an online guide that introduces interested parties to the theory and process of Photogrammetry for the purposes of rapidly 3D scanning objects in cultural heritage and creative contexts, with an emphasis on workflows for visitor engagement experiences.

Status

ScannerBox has been fully released online as an introduction and guide to Photogrammetry-Based 3D scanning for Cultural heritage and Creative Industries. The nature of 3D scanning as a complex activity that requires a wide array of skills and resources, and ever evolving technical requirements, necessitates an understanding of the core challenges involved and the acquisition of a long view of the developing landscape. ScannerBox aims to equip those interested in attaining 3D scanning capabilities, with a software and hardware agnostic understanding of the theory and process, while sharing years of practical experience in relevant applications and use cases.

Description

3D scanning artefacts and environments is a quickly growing trend among cultural institutions. However, they tend to focus on preservation, and the cost in time and resources is considerable. ScannerBox aims to provide organisations of all sizes and resource levels, with the knowledge they need to add 3D scanning to their capabilities with minimum overheads and a focus on ease of use.

At its core ScannerBox is a guide[1] – a crash course in Photogrammetry-Based 3D scanning with an inexpensive and user-friendly approach to technology that aims for rapid application by public-facing museums and galleries. It lists the affordable hardware and common skills that are necessary, spells out the process in simple terms, and – most importantly – introduces methods for effectively interacting with and disseminating the 3D content.

Figure 15. 3D Scanning with Photogrammetry following the ScannerBox Workflow

[1] http://www.mixedrealitystorytelling.net/scannerbox/

The ScannerBox guide enables museums to digitise their collections and archive them in a far more detailed and useful way than a simple photograph can offer. The outputs can be seen, shared, and interacted with on any platform. They can be used for research, but also in a gallery, or 3D printed into a collection of visitor-contributed artefact galleries. In essence, ScannerBox helps museums build collections of 3D assets that they can leverage as a powerful resource for engaging visitor experiences, both on-site and online.

Importantly, the guide also enables engaging visitor experiences: The Photogrammetry-based scanning method is considerably faster than other techniques under the right circumstances. By leveraging this speed 3D scanning can be incorporated into visitor experiences in several impactful ways. For example, by 3D scanning their own objects at the museum, visitors can contribute their own content to the museum archive and experience museums as co-curators of their own histories.

Figure 16. 3D scan[1] of the Veiled Vestal[2] at Chatsworth House

Alternatively, they can interact through 360 degrees of movement with the museum's own collections online. The scans can later be repurposed for richer experiences, as we discovered with VRtefacts. Thus, visitors can quickly create and/or access richer and more meaningful personalised experiences to keep for themselves and share with others.

[1] https://sketchfab.com/3d-models/chatsworth-house-veiled-vestal-virgin-test-2-a8ba9640105348f2961ec2685a823e30
[2] https://www.chatsworth.org/art-archives/devonshire-collections/sculpture/a-veiled-vestal-virgin/

Visitors can enjoy the fun and engaging experience of having the museum turn their personal objects, or things they made during their visit, into 3D models that they can keep and share with friends or the public, and perhaps even remake at a later time in virtual environments or through 3D printing, such as with VRtefacts.

ScannerBox is an active tool used by several academic and creative endeavours and thus is planned to be kept relevant and up to date for the foreseeable future as a state-of-the-art resource for 3D scanning.

Deployment: The National Museum in Belgrade

Over the summer of 2018, the National Museum in Belgrade[1], in collaboration with NextGame, employed the ScannerBox workflow to create an interactive experience for hundreds of visitors. People were invited to bring personally meaningful objects to the museum to have them 3D scanned and tell the stories behind them, creating a collection of 3D models and corresponding narratives.

Figure 17. Examples of the meaningful objects brought to and scanned during the event.

Several dozen objects were contributed for scanning, with 46 high-quality 3D models being produced and made available through the museum's public channel[2]

Deployment: Tate Modern

ScannerBox was also employed in the late summer 2017 at Clare Twomey's "*Exhibition Factory – The Seen and the Unseen*"[3] at Tate Exchange[4]

During the event visitors were invited to create their own ceramic objects, either from a mould, or sculpted freeform. As the visitors could not take the still-wet clay objects with them, the experience was designed to have them exchange it with one of several thousand other ceramic artefacts that had been made at a previous exhibit. As described in the Artcodes section of this document, the visitors would be able to track the 'life' of the object they made (and let go of).

[1] http://www.narodnimuzej.rs/3d/?lang=en
[2] https://sketchfab.com/NationalMuseumOfSerbia
[3] http://www.claretwomey.com/projects_-_factory_the_seen_the_unseen.html
[4] https://www.tate.org.uk/whats-on/tate-modern/tate-exchange/workshop/factory

Figure 18. ScannerBox deployed at the Tate Exchange

However, by integrating ScannerBox into the experience[1], visitors could be offered the opportunity to have their creation scanned before they exchanged it. Of the hundreds of artefacts that were created most were scanned in an optimised ScannerBox-driven process which compressed the scanning time for each object to about 3 minutes, meaning that for there was minimum queuing and disruption for the visitors, and therefore deviation from the original vision of the experience.

The created 3D models were made available online for visitors to find and share online. Each model had the visitors card 'baked in' by having it part of the model. This also allowed visitors who had misplaced their cards from the experience to scan their Artcode straight off the 3D model.

Figure 19. Examples of a sculpted flower and a moulded jug made by visitors and scanned with ScannerBox

[1] http://www.mixedrealitystorytelling.net/factory-the-seen-and-the-unseen/

VRtefacts

VRtefacts is a novel Virtual Reality experience that combines 3D Scanned object with their 3D printed copies to create passive haptic VR experiences with the aim of enabling storytelling and story capture from museum visitors.

Status

Enabled by several of the GIFT toolbox developments, such as ScannerBox, VRtefacts has been designed, implemented and trialled as a multifaceted mixed reality storytelling experience. The vision for VRtefacts is for it to act as a novel way for visitors to explore museum collections, and importantly, to provide a way for them to contribute to the collection. VRtefacts is a complex creation involving 3D scanning, 3D printing, Object Tracking and Virtual Reality, however it has been designed to be replicable, adaptable and scalable for use by any interested party. The source code and resources for the initial demonstrator have been released as a template on GitHub[1].

Description

VRtefacts[2] is a museum-focused virtual reality (VR) experience designed to heighten a visitor's sense of connection and engagement with items from the collection, ending with visitors donating a personal 'story' (memory, association, or other reaction) triggered by that object. VRtefacts uses 3D scans of museum objects overlaid in VR onto physical 3D prints of those scans. The visitor can actually feel, manipulate, and view the objects up close – in VR and in the real world. Their stories are recorded in both the actual and virtual space. The end result, at this stage, is a composite video that can be donated to the museum and used to build a complementary, visitor-led layer of interpretation and increase engagement with the museum.

Figure 20. Experience mediator handing the participant the artefact they have chosen to experience

[1] https://github.com/ddarz/GIFT_VRtefacts_Demonstrator
[2] https://vrtefacts.org/

Our initial deployments demonstrate that VRtefacts adds an element of the ‘quirky’, ‘surprising’, ‘out of this world’, ‘weird’, ‘immersive’, ‘fun’ and ‘cool’ to the visitor experience, even for those who are familiar with Virtual Reality. They almost always enjoy being able to touch and examine ‘the object’ up close (even though ‘the object’ is only a plastic 3D-printed replica of the actual artefact or even a non-physical 3D scan housed in a small acrylic vitrine) with a high-fidelity image overlaid on it. The storytelling element of VRtefacts invited engagement with personal memories that users felt happy to have been given the opportunity to revisit – though for others, it offered an exciting opportunity to invent fictions on the spot, or even to create new ideas for the craft they make their living from.

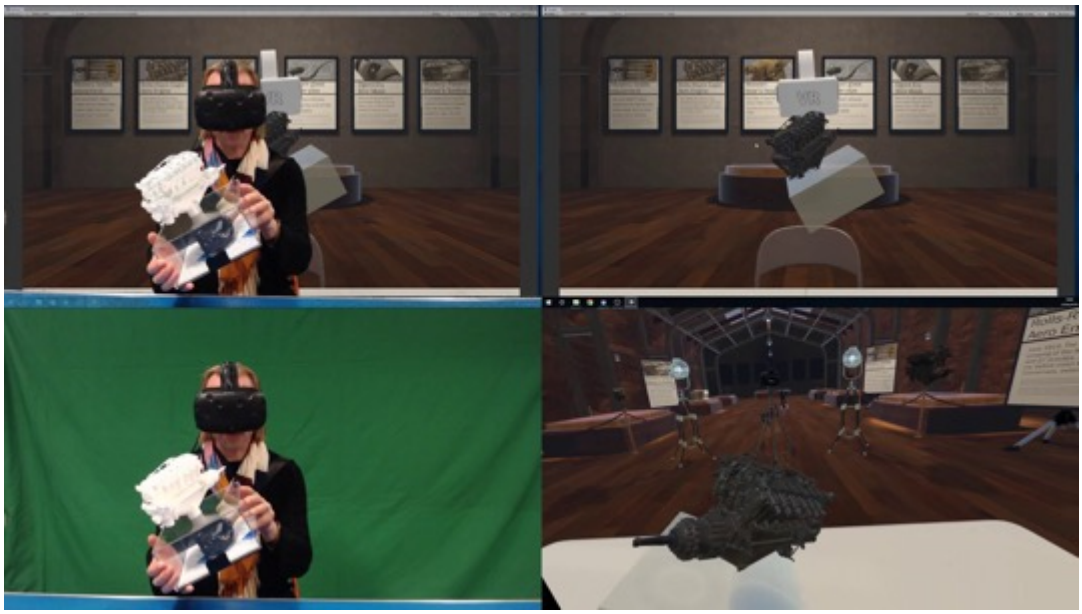

Figure 21. The output of VRtefacts combining several 3rd person perspectives and a 1st person view into a single video narrative.

For years, many cultural heritage institutions have felt pressure to engage with their community in more egalitarian, inclusive ways. This pressure may come from visitors, funding bodies, and the prevailing academic theories (through the ‘New Museology’) that their stakeholders are likely to have been trained in. VRtefacts addresses these pressures head-on, using digital technologies that can be easily used to create an ‘interpretive layer’ of visitor and community engagement that aims to be expansive and persistent, driving further meaningful interactions.

Figure 22: Examples of the 3D printed artefacts

Our initial VRtefacts project shows that it improves many visitors' sense of engagement with the museum and at worst does not detract. Critically, VRtefacts appeals to a wide range of visitors for a variety of reasons, primarily:

1. their strong positive reaction to the personal memories and thoughts that the experience gives them the time and space to explore,
2. an increased sense of connection to and understanding of the collection,
3. approval of the museum's attempts to experiment with new means of engaging with existing and untapped visitor bases,
4. the novelty and quality of Virtual Reality, especially using touch.

VRtefacts, especially at this stage is quite modular and accommodating in its approach. If an intuition is keen to highlight its engagement with digital technology but less interested in gathering participant stories, it can downplay or remove the story capture element and create a more elaborate VR environment with multiple stations for visitors to engage, perhaps within the collection space. Conversely if the institution is more interesting in developing visitor engagement through storytelling, but is highly constrained in terms of resources, it can eliminate the 3D prints entirely and offer high-quality 3D scans in a simple acrylic box, as was done as part of the Derby Museum Demonstrator Deployment.

VRtefacts is a slightly complex but powerful experience. To get started a museum would need:

- At least 6 or so 3D representations of objects from their collection, which can be generated in-house using our ScannerBox workflow.
- Optionally, 3D-printed versions of at least some of those representations. These can be obtained from commercial service providers or made in-house with affordable printers that can be used for many purposes. Lower-grade, less expensive prints suit VRtefacts well in most cases.
- A suitable VR setup and space for visitors to experience the objects. The VRtefacts template is available for download via the GIFT website for use as a starting point.

VRtefacts is by design an approach that is meant to be customised for each individual venue's needs, budgets, and capacities. From the objects and the environment, they are shown in, to the way the stories are captured, each aspect can be adjusted to fit the theme and purpose.

VRtefacts is launching as a series of experiences with several museum and gallery venues and is branching out beyond VR into Augmented Reality (AR) experiences. The available support, such as guidelines, documentation and software templates, is set to increase and will be made available on VRtefacts.org

Deployment: Derby Silk Mill Museum

We deployed[1] VRtefacts for the first time at Derby Museum & Art Gallery[2] on 22 and 23 May, 2019. This was an initial exploration of how they might use Virtual Reality Storytelling for their new Museum of Making[3], scheduled to open in 2020.

[1] https://vrtefacts.org/2019/07/12/how-it-worked-at-derby-museum-and-art-gallery/
[2] https://www.derbymuseums.org
[3] https://www.derbymuseums.org/locations/museum-of-making

Figure 23. (Caption) (Left) The VRtefacts experience at the Silk Mill Museum. (Right) The virtual museum and recording view of the participant

VRtefacts uses a combination of subtle techniques that can lead to fascinating, heartfelt, and insightful stories:

1. The visitor's experience was led by trained researchers who used carefully scripted techniques to lead visitors who might be intimidated by the prospect of being recorded to a point where they could comfortably give a coherent, personal response to their object.

2. Part of this transition was made possible by a camera and lights that exist solely in the VR environment. These contributed to a sense of significance that can enable the positive elements of storytelling without generating stage fright.

3. The manipulation of scale and substance in the three 3D prints allowed for and new connections and insights.

4. We also used 3D scans with no associated 3D prints. These were scaled to fit within an (actual) acrylic vitrine, which afforded many of the same types of interaction as the 3D prints. Visitors got to experience one printed object and one scanned object.

5. VR was enough of a novelty factor to entice the curious. Introducing touch increased the novelty factor and proved to be enjoyable and/or immersive for nearly everyone.

6. Storytelling made the objects feel more real, more personal, and often more engaging for most visitors. More than a few felt inspired to learn more about the objects and/or felt that they had learned something new about them, even though they had not 'learned' new facts from the curators.

Cardographer

Cardographer is a software platform to support and extend the use of ideation cards, including the VisitorBox deck that has been created to help museum professionals and other stakeholders envisage future interactive museum experiences. The platform encompasses tools which capture the usage of physical and digital ideation cards and provide insightful visualisation of the long-term card usage to help users reflect on their design thinking.

Status

Cardographer[1] is a prototype platform that is being actively developed by the project research team, and currently consists of an Android-based application that uses Augmented Reality (AR) techniques to capture the usage of the physical cards during workshops, a prototype PC-based version using digital cards, and a workflow to generate visualisations from the captured data. The team can support the usage of the capture tool during design sessions which utilised the registered card decks and can also assist in the design and incorporation of new ideation decks.
We have captured the use of the Visitor Box cards across 50 design sessions and made the resulting visualisation (in anonymised form) freely available[2] as an interactive online demonstration.

Description

Ideation cards, such as our own cultural heritage-focused VisitorBox deck, are a powerful and increasingly popular method for people with or without design training to generate design ideas within organisations. The very nature of cards as familiar physical objects is one of their strongest advantages. However, it is difficult to apply powerful digital tools to physical cards. In other words, how can people 'save, load, share and iterate' on their designs in the same ways they have become accustomed to with digital tools?

Cardographer[1] is an ecosystem of tools that enables users of compatible ideation card decks, such as the VisitorBox deck, to digitally capture your physical card-based design ideas into a repository of designs from which you can distil insights into trends, issues and opportunities. For a museum, this would allow the institution's team, representing the wide variety of knowledge, experience, roles, focuses and responsibilities, to use the benefits of physical cards, and also the force-multiplying digital enablers that we have come to expect, such as data analytics and intelligent decision support.

Our initial explorations of capturing data from the use of ideation cards originated in our experience of using the Mixed Reality Game ideation deck over two iterations of teaching Masters students at Nottingham. We realised that data about how students used these cards, especially which cards were helped generate which design ideas, could provide useful insights into our students' thinking as well as into the design and use of the deck. We published an initial study of this approach at the ACM's annual Computer Human Interaction (CHI) conference (with GIFT as a sponsor of the research) as:

> *Dimitrios Darzentas, Raphael Velt, Richard Wetzel, Peter J. Craigon, Hanne G. Wagner, Lachlan D. Urquhart, and Steve Benford. 2019. Card Mapper: Enabling Data-Driven Reflections on Ideation Cards. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI '19). ACM, New York, NY, USA, Paper 571, 15 pages. DOI: https://doi.org/10.1145/3290605.3300801*

[1] http://www.mixedrealitystorytelling.net/cardographer/
[2] https://visitorbox.org/activity-rules/

This inspired us to develop the generalised Cardographer tool within GIFT that can work with multiple decks of cards, including with the Visitor Box deck for deigning interactive museum experiences. Beyond the benefits of using ideation tools such as the VisitorBox ideation card deck, Cardographer allows users to tap into a larger knowledge-base of accumulated insights, allowing them to visualise long-term patterns of usage within organisations and among all the users of that deck. Such insights can help you find gaps in strategies, identity untapped opportunities and chart paths through issues identified by communities of people creating visitor experiences for museums.

Visitor Box

Before discussing the deployments, we briefly summarise the Visitor Box deck of cards. Ideation cards have become an established tool in contemporary collaborative design, evaluation and problem solving activities, both in industry and academia. There is a considerable number of ideation card decks available, covering a vast array of contexts and applications, to various degrees of depth.

Figure 24. Examples of VisitorBox Design outputs

Visitor Box is a card-based tool, which is designed to support the creation of visitor experiences, particularly for museums and other entities of the Galleries, Libraries, Archives and Museums (GLAM) sector. Unlike most ideation decks, VisitorBox utilises a structured method to effectively engage with the stakeholders.

This method involves using the cards too first identify and crystallise the exact objectives and goals of the organisations, and then identify the assets, resources and crucially, the audience, that they have access to. Following these establishing steps, the cards enable the users to design experiences that utilised their assets and resources to best achieve their identified goals. The process[1] and cards are freely available on the tool's website[2] and can be downloaded and printed for immediate use.

The core Visitor Box deck was developed outside of the Gift project with funding from the UK's Arts and Humanities Research Council (AHRC). GIFT has then integrated this deck with the Cardographer tool, deployed the deck within 50 design sessions as described below, and consequently built up and visualised an initial dataset of museum designs and associated card usage data.

Capturing data about card use

Cardographer has two main aspects: The first is **Capture**. The Cardographer platform uses computer vision technology to capture the usage of the cards during design sessions, thus documenting the design rationale as the cards are used and recording the final result of each session. Each design output is saved into deck-specific repositories, which can be private, on a per-organisation or individual basis, or public and open to any user of that type of deck, depending on the designer's preferences.

[1] https://visitorbox.org/activity-rules/

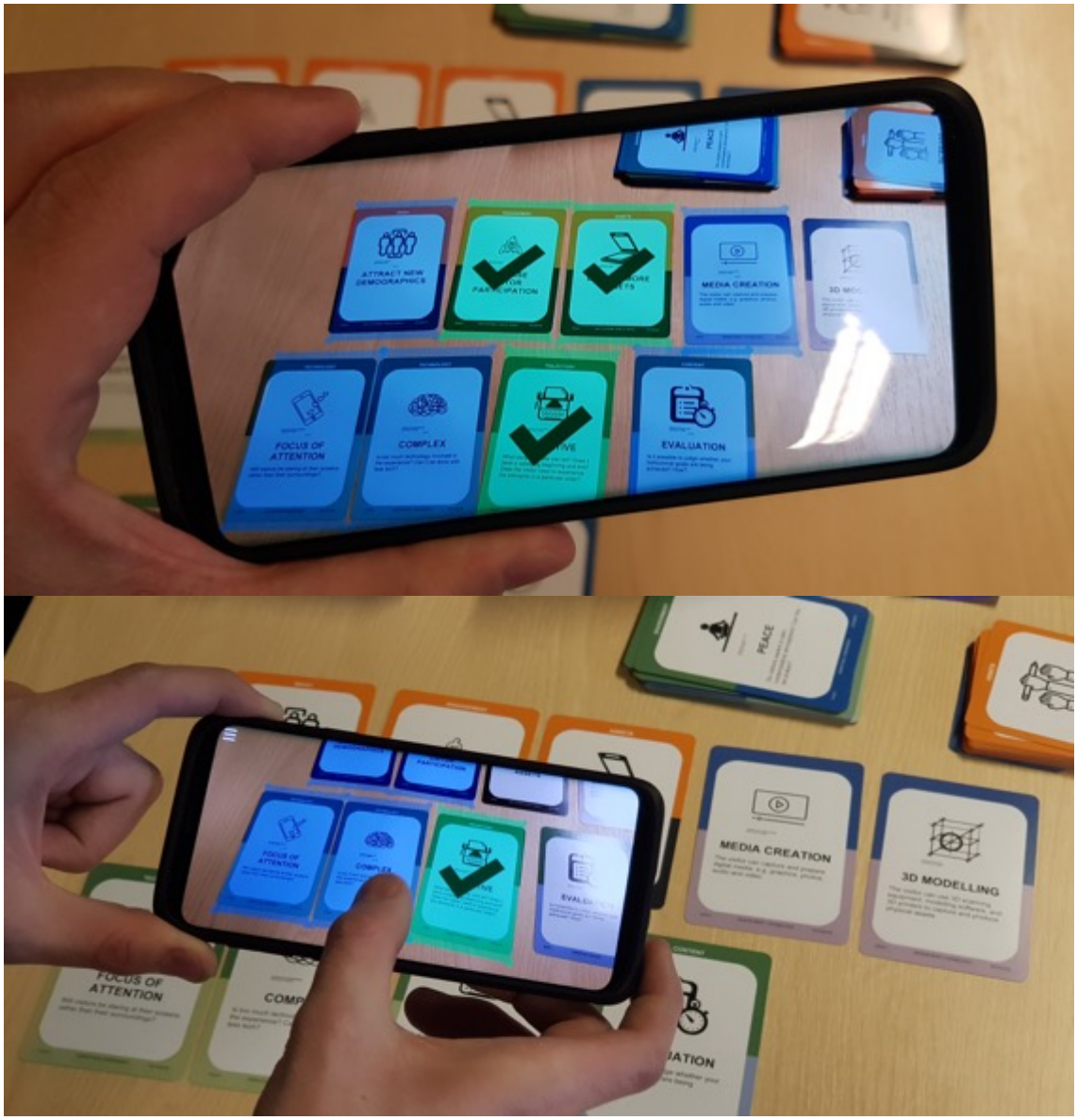

Figure 25. Capturing Card Based Designs using the Cardographer Scanner app

The dataset

One of the outcomes of the Cardographer work has therefore been to generate an initial dataset that provides some initial insights into how cards were used and to which we can add later on. This was captured from 10 workshops as shown in the table below.

Workshop	**Type**	**Number of designs**	**Was this stage of the process documented?**				
			Context	**Goals**	**Design**	**Ideation**	**Disruption**
ITU workshop	Training	12	Partial	Partial	Yes	Partial	Yes
Nottingham PhD workshop	Training	3	No	No	Partial	Yes	Yes
Uni Illinois workshop	Training	6	No	No	Yes	Yes	Yes

DHL workshop	Professional	1	Yes	Yes	Yes	Yes	Yes
Emotion workshop	Professional	4	No	No	No	Yes	Partial
Heritage Symposium	Professional	4	Yes	Yes	Yes	Yes	Yes
JLU workshop	Professional	8	Partial	Partial	Partial	Partial	Partial
Mainz workshop	Professional	8	Partial	Partial	Partial	Partial	Partial
National Trust workshop	Professional	2	Yes	Yes	Yes	Yes	Yes
Terni workshop	Professional	11	No	No	No	Partial	Partial
TOTAL		**59**					

For each of these designs we used Cardographer to document the cards that were used and to also capture images of the design posters and/or other documents that were produced at the workshop. The table shows that this appears to have resulted in partial coverage of the entire picture of card use, most likely for a combination of reasons: not every workshop or every group within a workshop may have followed or documented every stage of the process or workshop facilitators were unable to capture the outputs before they were destroyed. The latter suggests improving the capture process in the future or perhaps even considering developing digital versions of the cards and a supporting ideation tool that would automatically capture all card use, though this may cut against the evident popularity and flexibility of physical cards,

Collectively, our workshops employed the cards to work up 59 different documented designs. The average number of cards used in a design was 15. The smallest design included 3 cards and the largest design featured 43 individual cards.

Considering the types of designers involved, 3 of the workshops were to train students as part of courses at ITU, University of Nottingham and The University of Illinois and these accounted for 21 of the designs, while the remaining 7 workshops were targeted at museum professionals and accounted for 38 of the designs. It might be interesting to treat these (or indeed other) categories of users separately or even compare them in some analysis. In what follows we consider them together as our ‘designers’.
The table reveals considerable variety between the various workshops and hence individual designs with regard to whether they followed and documented all of the stages of the Visitor Box process. While some designs are documented to have used every step in the process, most did not.

- 11 Designs had all five stages documented resulting in card use being fully captured across the entire Visitor Box deck.
- 2 designs had 4 phases documented, here either the main goals stage or the idea disruption was missing.
- 15 designs featured 3 stages. Here most, 12 out of 15, featured the design brief, an idea expressed through the ideation cards, and a disruption of the former. This includes all six designs from the University of Illinois workshop in the United States. 3 designs featured the context, goals and the ideation. These three were all worked during the same workshop in Mainz, Germany.

- 16 further designs only documented 2 of the Visitor Box stages. Here the most common combination was ideation and disruption of the same, with 9 examples. Alternative combinations were having a design brief and disruption, but no ideation (4 designs), design brief and ideation (1 design) and context and goals (2 designs).
- Finally, 13 designs only had one VisitorBox stage expressed through cards. Most of these, 11, just featured the ideation aspect. 2 focused exclusively on disrupting. Many of these however, especially those with one or two stages, did also include hand writing notes or story boards, suggesting that other parts of the process were followed, but not documented through Visitor Box cards.

This picture may reflect the complexity of the overall Visitor Box process and the time it takes to fully complete it (which may not always fit a short workshop format) as well as the interests of the participants (some way wish to quickly proceed to ideation while others may wish to take their time setting the scene first).

Analysis and visualisation

The second aspect of Cardographer is **analysis and visualisation**. Simply counting the popularity of cards used might yield some preliminary insights as to their users' – curators', designers' and students' – attitudes towards interactive technologies in museums. In this regard the Visitor Box deck acts as a kind of survey tool to help reveal how the sector is currently thinking. The value of deriving insights from card use may be that users have to carefully consider each concept they encounter and make an explicit choice as to whether or not to include it in a design – an implicit vote that involves a considered choice.

The following paragraphs summarise the popularity of cards under each category (along with the count of how many times they appear in the Dataset) to give an overview of our users' collecting thinking. Cards (and hence issues) are listed in order or descending priority.

Some of the cards help us better appreciate the overall context for design:

- The **Goals** cards reveal their overall priorities as: New demographics 12, Use assets in new ways 9, Visitor participation 9, Change visitor attitudes of beliefs 8, Educational activities 4, Visitor numbers 3, Digitise more assets 3, Visitor spend 2, Visitor satisfaction 2, Brand awareness 2, Greater proportion of assets 2, More funding 1, Social media diversity 1, Reduce venue costs 1, Donations 1, Outreach 1, Visiting party size 0, Membership 0, Visit duration 0, Increase volunteering 0, Social media reach 0, Increase online visits 0, Visitor satisfaction 0, Data driven decisions 0, More diverse assets 0, Visitor ambassadors 0, International reach 0, Repeat visits 0.
- The **Motivations** cards reveal how they see visitors' motivations for engaging: Curiosity 13, Stimulation 9, Social interaction 7, Academic interest 5, Aesthetic pleasure 5, To make and do 5, Cultural identity 4, Entertainment 3, Time travel 3, Inclusion 3, Wonder 3, Personal relevance 3, Nostalgia 2, Escapism 2, Stimulate the children 2, Self-improvement 1, Comfort and warmth 0, Contemplation 0, To be moved 0
- The **Barriers** cards reveal major barriers to digital technology adoption as being: Irrelevant 17, Hidden 10, Overlooked groups 9, Educationally disadvantaged 6, Flow 5, Discrimination 4, High cost 4, Unstable connectivity 3, Low self-esteem 3, Socially isolated 3, Poor signage 3, Accessibility 2, Peace 2, Risk 2, Lack of access to technology 2, Restrictive opening hours 1, Politics and policies 1, No fixed abode 0, Poverty 0

Visualising the Visitor Box usage dataset

Beyond listing this data, it might also be helpful to visualise it. We have explored how our dataset can be viewed through two complementary visualisations. The first is the **Cards Perspective**[5] which gives an overview of all of the cards in the deck and how they have been used as shown below.

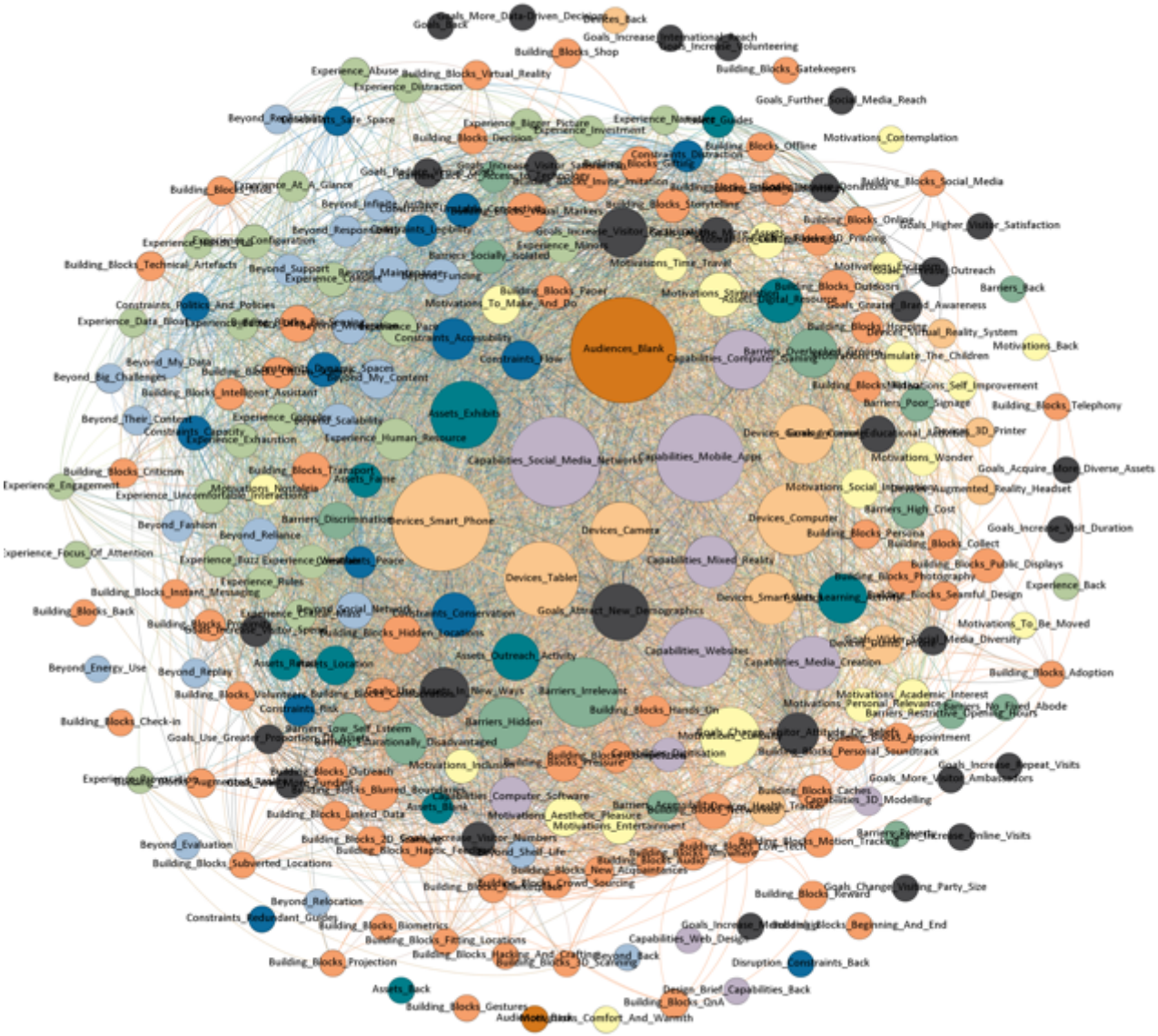

Figure 26. The cards perspective of the VisitorBox dataset Cardographer visualisation

The visualisation takes the form of a network graph, with each node representing an individual, the size of which represents the total of how many times this card has been used across all the designs in the dataset. The colours match those of the physical cards which conveys the theme to which they belong in the deck. Each link between two card nodes denote the number of times that they have co-occurred in the database of designs (i.e., how often have they appeared together in the same design), with the thickness of the link representing the frequency of these co-occurrences. The card nodes are positioned according to the density of these links. As a result, frequently used and co-occurring cards tend to appear near each other in the centre of the visualisation while less frequently used ones appear towards the edge. That's that are not often used together tend to be positioned far apart. The visualisation is interactive, supporting zooming and panning and also selecting individual cards to show their strength of connection to other cards and data about their use.

The second related visualisation is the **Designs Perspective**[6]. This shows all of the (currently over 50) designs in the dataset. This is also a network style graph. Each design that was generated using

the cards is shown as a node, with the size representing the number of cards that was involved in generating this design – which can be an early indicator of their complexity.

The placement and proximity of the nodes is an indicator of the similarity of the designs in terms of the number of cards they share in common. Two designs are linked if they share at least one card in common. The thickness of the link denotes the number of such shared cards. Again, the placement reveals the centrality or otherwise of designs, at least in terms of the cards they use. Those that use many cards and/or share many in common tend to appear near the centre. This that just a relatively few distinct combinations of cards – which might be a clue as to potentially distinctive thinking - tend to lie towards the edge.

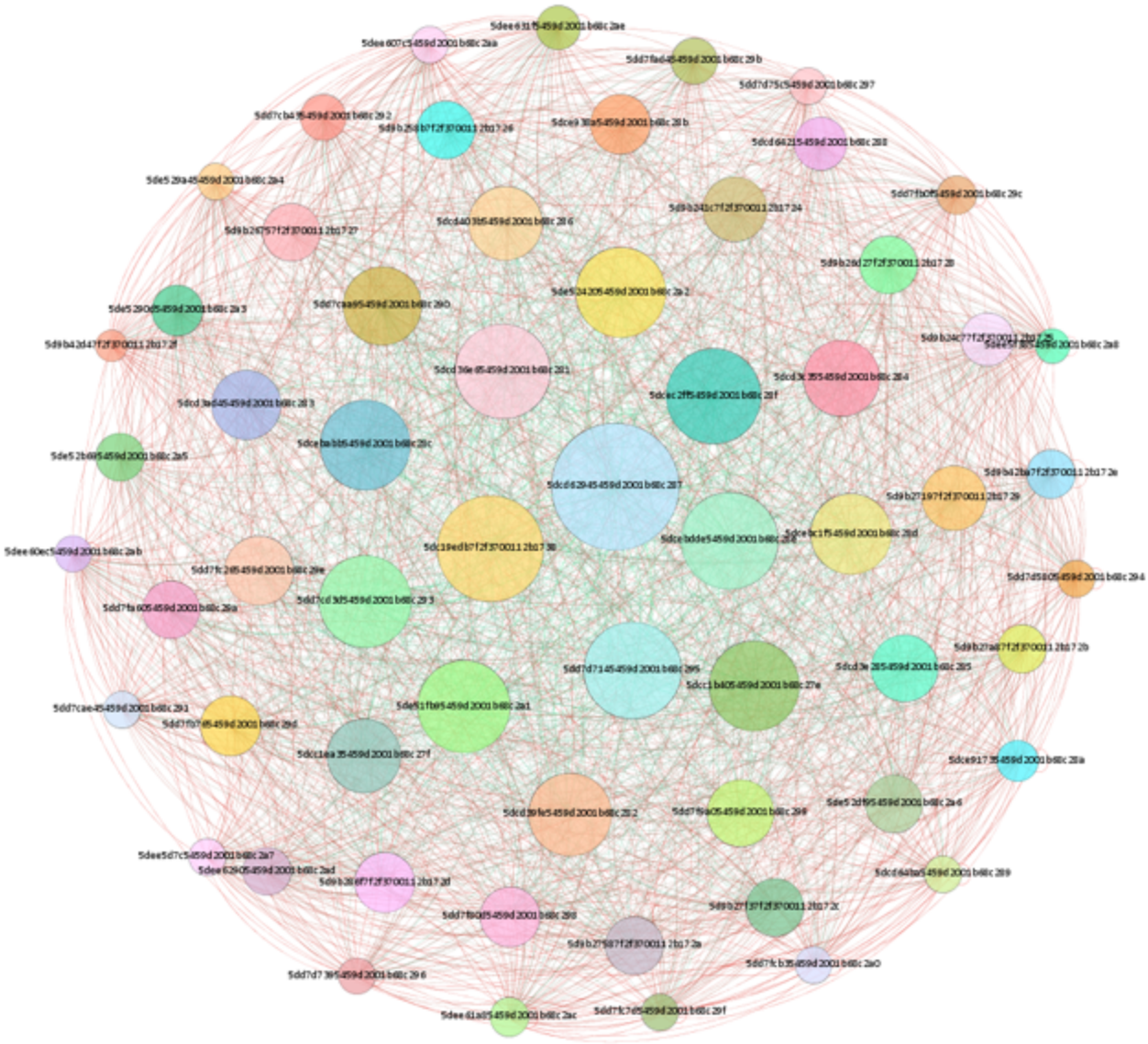

Figure 27. The Designs perspective of the VisitorBox Cardographer dataset.

Supporting reflection

The dataset and visualisations also enable the card developers and session facilitators to reason about the design and use of the overall deck of cards. On exploring the Cards Perspective, the original designer of the Visitor Box deck commented:

> *"As a deck designer I think it is interesting to look at the cards in terms of stages and categories, e.g. it is interesting to see the visitor motivation 'to make and do' closer to the centre than 'academic interest', or the visitor device 'camera' close to the centre vs 'VR kit' close to the edge. This would encourage me to consider whether the edge cards need removing from the deck, or whether the process needs changing to ensure that players are considering these cards (is the language on those cards off-putting? Do players need more help to find out if visitors have those motivations/devices?)"*

They were interested in some of the less used cards too:

> *" ...the orphans, some of which are quite surprising. No-one chose 'increase visit duration' as their goal? That's really surprising to me and is either an interesting reflection on the domain (so should that card still be in the deck?) or again is a reflection on the process (is that card too similar to another card? Is it not interesting enough to be salient to players in that game stage, which is pretty hectic?)"*

They also suggested that it could be informative to see more of the process by which the design had unfolded, for example in terms of which cards employed at an early stage might have led others at a later stage, which suggests a direction for further development of this visualisation I the future:

> *"I can see what cards played in one stage might naturally lead to particular cards in subsequent stages; for a while I've been interested in whether players might be given hints along the way, i.e. "you've played card X previously, so you might want to look at card Y now ...", or equally provoked to do something atypical "you played X previously, so I think you're likely to consider card Y, but why not think out of the box and consider card Z ..."*

A researcher currently developing another deck of cards(for designing food experiences) that are also to be integrated with Cardographer commented:

> *"For me the central elements of the visualisation and the most used cards can be interpreted as showing concerns and technologies that the museum stakeholders are familiar with and therefore focused on engaging with (maybe an element of design fixation). Focusing on the central elements, it would appear that the stakeholders ideas are focused on using tablets, smartphones, apps, to interact with and engage with their audiences, with the goals of using their assets to engage with new audiences. The comparatively little used cards around the edges of the visualisation appear to be more specific elements which the stakeholders may have less familiarity with, and have therefore used the concepts less in their designs due to lower understanding and confidence. Having said this I would imagine that more distinction between these more peripheral elements would emerge with greater use of the cards with genuinely unfamiliar, or less useful concepts being pushed further to the fringes of the visualisation with more use."*

And suggested that:

> *"The upshot of this visualisation could be to advocate for a greater awareness raising of the nature of technologies within museum stakeholders so that they can move beyond the familiar ideas of smartphone apps and see how appropriate they would be. The visualisation could also be interpreted as representing thinking whereby technology is placed centrally, whereas reflection could perhaps better serve the needs of the museums if the goals of the institution were more prominent (and central to the visualisation) and the technology use was secondary*

to that (and maybe more peripheral on the visualisation) but this may require a different approach our use of the cards or a level of familiarity and awareness raising of the stakeholders, prior to engaging with the visitor box process."

Subsets of these designs will have been generated by a particular organisation and/or as part of a particular design process and it can be interesting to compare these to the whole to see how this organisation is positioned in terms of its use of the cards. The most detailed case we have of this to date is the use of the cards to teach the ITU Masters students, especially as each was scored by both the course convenor who graded them as overall student solutions and an independent museum professional who graded the designs for suitability to be deployed in a museum (and who commented "we would actually implement this at the national gallery"). The following visualisations highlight the ITU students' designs in the visualisation and use colour to show their grade/suitability (from yellow for highest to grey for lowest).

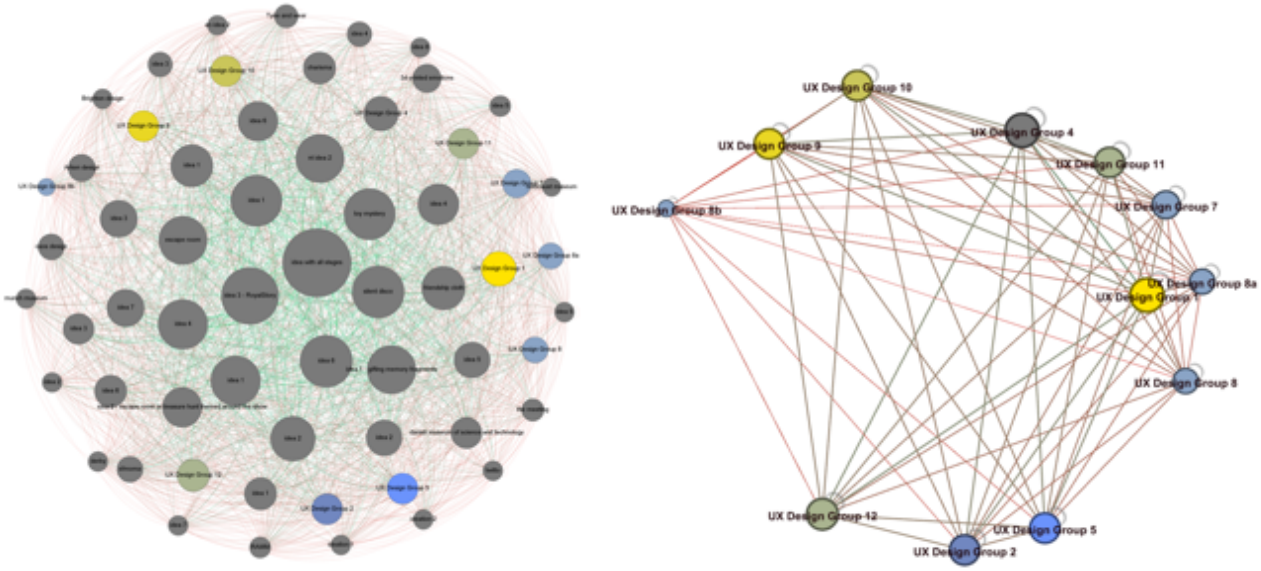

Figure 28: Highlighting the 12 ITU students designs and colouring them according to their overall grade

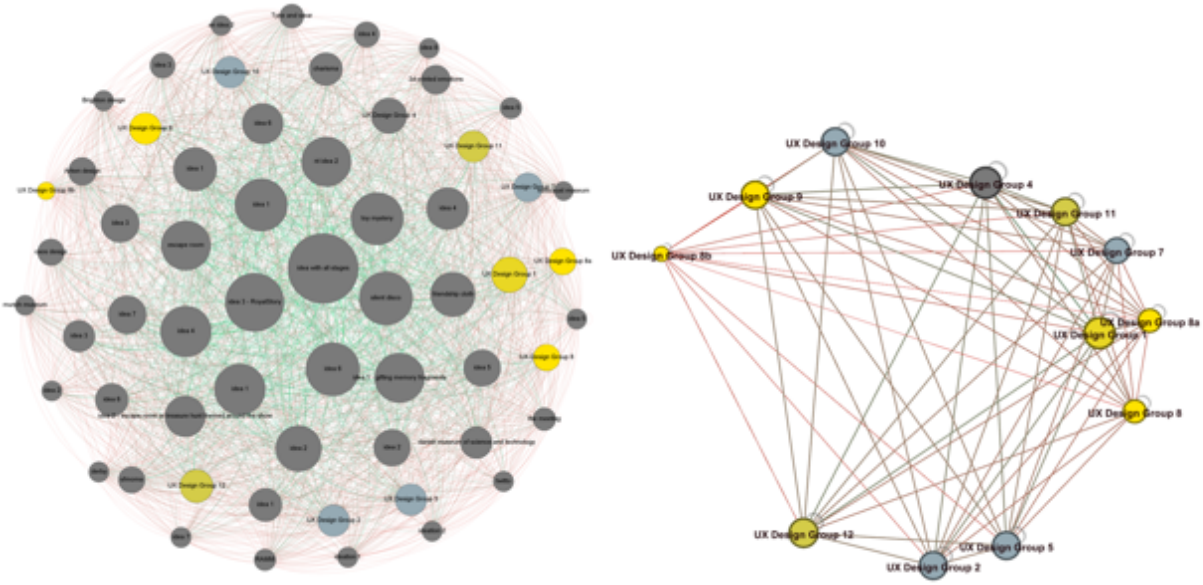

Figure 29: Highlighting the 12 ITU students designs and colouring them according to their suitability

On being asked to reflect on the similarities or otherwise of students' solutions before we revealed their identifies in the visualisation, the course teacher commented that:

- "Groups 7, 8, 11 were variations over the same concept, Tinder-style, the user swipes left/right on a bunch of artwork to indicate preferences to be matched with personalised content.
- Groups 2, 5 and 12 were all somewhat conventional designs (in my opinion), and not very original (though different from one another)
- Groups 4 and 9 were also very similar designs (learning games about interpreting artworks for school students)"

These reflections seem to reasonably match their groupings in he visualisation, suggesting that the visualisation may potentially offer some useful support for helping teachers and indeed other design facilitators explore the similarities between and groupings of design solutions.

We suggest that both visualisations and the underlying data might be useful to design facilitators who employ the cards within a session. They might, for example, choose to emphasise the use of certain cards over and above others at key stages of the design process, for example requiring the use of 'rare' cards to encourage thinking 'out of the box'. Longer design processes that involve several sessions spread out over time might allow for the steering of a set of ongoing designs, for example encouraging groups to diverge in their thinking by restricting which cards they can use relative to others.

Another possibility that we are exploring in ongoing work beyond the project is to create digital card games that allow the cards to be used in online design sessions and that automatically capture rich data about card use and that might even include 'AI dealers' that try and shape the design process by recommending more or less rare cards.

In summary, the development of Cardographer within GIFT and its integration with the existing Visitor Box deck of cards has allowed us to capture a unique dataset of how museum creators, designers and other stakeholders think about a range of concepts issues and technologies. While much work remains to be done in terns of richer data capture and deeper analysis, our results so far suggest that this approach – and supporting tool – can deliver new insights into: -

- How the sector thinks about issues and technologies that go beyond simple surveys
- The contents of the Visitor Box in terms of the cards it should contain
- The best use of the Visitor Box within a given design session
- The ability for users to reflect on and compare the design ideas that emerge from the process
- Implications for the design of future digital design games with AI support

1. http://www.mixedrealitystorytelling.net/cardographer/
2. https://visitorbox.org/activity-rules/
3. https://en.itu.dk/programmes/bsc-programmes/digital-design-and-interactive-technologies
4. https://www.smk.dk/en/
5. http://mrl.ddarz.net/index.html#VisitorBox_Cards_v7.gexf
6. http://mrl.ddarz.net/index.html#VisitorBox_Designs_v1.gexf

Emotion Mapper

Emotion mapper is mobile survey tool that enables visitors to provide their emotional response to experiences through a combination of answering free text questions and rating themselves on scales derived from published models of emotion. The tool then provides visualisations of the results to enable reflection on emotional responses to an exhibition or individual exhibits by different combinations of participants.

Status

Emotion Mapper is a prototype tool that emerged from work in WP3 during the second phase of the project. It is currently available from the project research team, while an interactive anonymised version of the munch visualisation is available online[1] and the source code for the current prototype components is available through GitHub[2]:

Description

Emotion Mapper is a customisable tool to help visitors explore and museums learn about emotional responses to their collections. It is designed to help museums create quick, simple, customised emotion-reporting questionnaires for selected items in their collections. Visitors view a selected item and answer questions via text and/or moving markers on a sliding scale. The data gathered is then compiled into visualisations that can offer insight into how visitors might be reacting emotionally to individual items. Museum staff choose which items are included, and then customise those questions to gather exactly the information they want. Meanwhile, visitors get a thought-provoking opportunity to reflect on their emotional response to various works.

It is important to note from the outset that we see Emotion mapper as a tool for enabling people to reflect in the nature of their emotions – and the meaning of emotions in general – within the context of museums. Although it can make use of what might be called 'scientific' models of emotion that have emerged from psychology (e.g., the Circumplex model based on valance and arousal used below), we do not envisage it as a scientific tool, by which we mean that we are not heavily invested in the unquestioned truth of these models, but rather see them as something to be explored, played with and potentially even challenged as part of designing emotionally engaging and reflecting visiting experiences. Rather than seeking to 'measure' emotion, the tool aims to stimulate reflection on and discussion of emotion, including of underlying models. This is reflected in the design of the tool as a series of visualisations that are somewhat ambiguous and open to interpretation rather than as a data analysis tool that tries to give concrete and numerical answers.

Visitors get the chance to reflect on how they feel when they engage with a particular artefact or artwork. Because they are prompted to think about a single emotion, they are not pressured to be more introspective than they are comfortable with. Also, because of the simple interface, they are not pressured to be deeply articulate. They are even free to indicate that they feel the opposite of the emotion being asked about – or nothing at all. The version below – which was deployed at the Munch museum – asks them to enter some free text to describe how they feel and also rate this on the two dimensions of the Circumplex model. The general version of the tool allows for the editing or the free text questions (e.g., to be more or less specific or provocative) and potentially to plug in other rating scales corresponding to other models of emotion.

Visitors may engage with Emotion Mapper through bespoke interfaces that are designed to be part of particular museum experiences. The following example is from the Sensitive Pictures experience developed for the Munch Museum by Next Game as part of Workpackage 3. This example involves a single free text response to the instruction "Briefly describe the way you feel" and then invites participates to set sliders to rate themselves as being happy or unhappy (valence) or calmed or excited (arousal). Other and more complex presentations, including the use of more questions and alternative rating scales are possible. The tool is open to creating various bespoke representations of the rating scales for different visitors. Concepts such as 'valence' and 'arousal' have defined technical meanings that may not be obvious to lay audiences and so need communicating in a way that suits a particular application and audience. This might, for example, use representations such as the "affective slider model" as part of the Assessment Scale for the measurement of Human Emotions[1]. The artistic team who delivered Sensitive Pictures opted for their own emoji style representations as shown below. An open question for further research is to explore how different audiences understand such symbols, which may be loaded with various personal and cultural meanings, and how this might affect the data that is captured. To what extent should or can there be a standard representation that works for all and gathers data in a common and comparable way, or should the representations – and hence the data they capture – be open to more subjective and artistic representations?

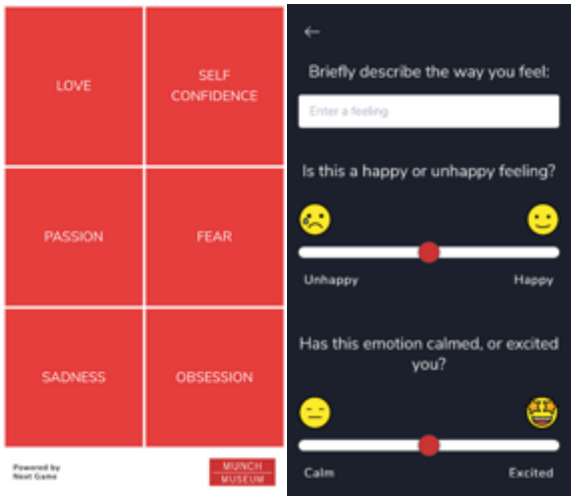

Figure 30: The customer mobile interface for Emotion Mapper deployed in Sensitive Pictures

The admin dashboard

Emotion Mapper provides an admin dashboard, where curators can design these kinds of emotion surveys and manage the Emotion Mapper Tool Collections (EMTC), along with viewing gathered data for each EMTC. Inside the dashboard, the interface allows the user to view visitors's emotional responses to exhibits via various visualisations. Visualisations can be generated for any combination of visitors' responses to any combination of exhibits from the museum's collection and so can include:

- An individual visitor's response to an individual exhibit
- A personal profile of an individual's responses to all exhibits they encountered and rated
- An exhibit profile that combines responses from all its visitors
- An aggregate summary of visitors' responses to the exhibition as a whole – all visitors responses to all exhibits

[1] https://www.researchgate.net/publication/293120723_The_Affective_Slider_A_Digital_Self-Assessment_Scale_for_the_Measurement_of_Human_Emotions

We propose that such visualisations might also improve the overall visitor experience by providing an interactive method of helping them think more about their emotions in relation to a museum's collections. This can provide novel insights into their own feelings during their visit. Focusing on feelings rather than simply viewing or gaining information may increase repeat visits, as they may like to see how their results change over time and under different circumstances.

Museum professionals gain a novel way of increasing emotional and reflective engagement with their collections and to gather useful data on how their visitors respond on an emotional level to individual artefacts, artworks, or collections. They might even print out exhibit profiles as part of signage or personal profiles as part of souvenirs.

The various EMTC collections that curators can create are stored inside the associated Emotion Mapper Server. Here they are stored as JSON strings, waiting for the user front end of Emotion Mapper to convert them into questionnaires for the participants. The current prototype of Emotion Mapper creates visualisations based on the Circumplex model of Emotion. In the Circumplex model, the emotional response is split between how positive/negative the emotion is (Valence), and how active/inactive the emotion is. As participants answer the various questionnaire modules, their response gets mapped into the Circumplex model, along with the free text answer they choose to insert. In order to create the visualisations, first the curators need to decide which items from their collections they would want to include in an EMTC. During the creation of the EMTC, the curators would need to select the type of visualisation that they would want to create for their items, *in the current prototype only the Circumplex Model is available*, and then add the specific module types to the EMTC in order to allow the collection of the correct data for the visualisations. Once the items have been selected, the curators would then create individual exhibit objects for the EMTC. This includes adding an image of the object, along with a name and description, to allow participants to identify the item. Here the curators can add any additional modules they desire, which allows them to gather any extra data from items in their collection, *currently in the prototype this feature is limited*. Once every item has been setup, the curators can then either use the standard Emotion Mapper user web app, or connect their own custom user app, to display the items to participants and allow them to go through the experience.

The Sensitive Pictures experience created by NextGame at the Munch Museum in Oslo, Norway, used Emotion Mapper as a core part of its offer. Because Emotion Mapper is a tool for museum professionals to create their own user experiences based on their own unique collections, NextGame was able to develop their own particular front end to Emotion Mapper, called MuseIs, to create a bespoke Munch visiting experience. Deliverable 3.4 presents the user test of Sensitive Pictures, and a series of data visualisations using Emotion Mapper to reflect on visitor's emotional responses and computational emotion data.

While very much a work in progress, we suggest that such visualisations have the potential for future development in several key areas:

- As a mechanism for encouraging emotional reflection during and after museum visiting experiences as noted above. Visitors might contribute their data at various points during an experience, and encounter the results on signage, posters, interactive displays, postcards, badges, tickets and other points.
- As a device for communicating models of emotion from psychology and enabling people to engage with them, explore their boundaries and challenge them. This is important as such as models are adopted by Artificial Intelligence, for example in the field of Affective Computing. There is an ongoing debate as to the validity of such models and indeed the

whole idea of whether emotions can be reduced to a few simple parameters in such ways or rather, are complex multi-faceted concepts that are socially constructed and subject to ongoing interpretation. Museums and similar cultural instutitions might play a key role in fostering this debate, using mechanisms such as this.

- Supporting new ways of understanding people's emotional responses in consumer science.
- Enriching human-computer dialogue in conversational interfaces. Such tools and their underlying datasets may eventually suggest new ways of enriching the emotional vocabulary of conversational agents, with wider implications to all manner of products and interactions.

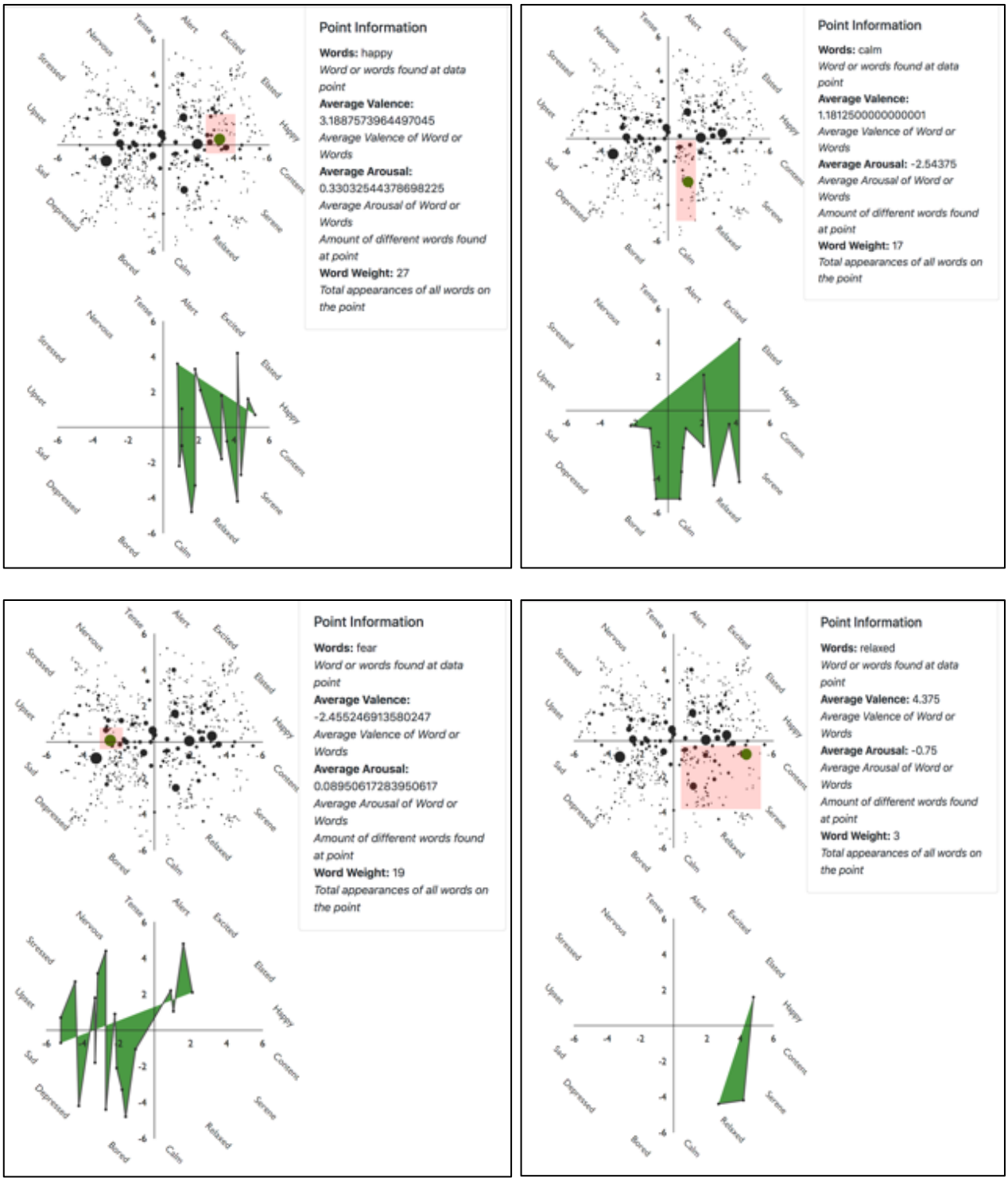

Figure 31: a selection of emotional footprints for specific words from the dataset

1. Due to limitations imposed by the personal data protection guidelines of the project, the visualisations online can only be accessed by the reviewers of this report. Information about how to access the webpage will be sent to the project officer.
2. User Interface: https://github.com/EdgarBodiaj/EMT-Interface-User
   Admin Dashboard: https://github.com/EdgarBodiaj/EMT-Interface-Admin
   Database Server: https://github.com/EdgarBodiaj/EMT-Storage
3. https://gifting.digital/emotion-mapper-and-the-munch-museum/

Gift Viz

Gift Viz supports the visualisation of data generated by the gift app to show: (i) levels of 'drop off' as users progress through the gift giving experience; (ii) the popularity of chosen gift items and their locations in museums; and (iii)patterns of gift exchange in terms of who gave what to whom.

Status
Gift Viz is currently a prototype too that emerged in the latter stages of the project to help evaluate deployments of the Gift tool. It is currently available by contacting the authors of this document, although anonymised interactive versions of visualisations from the Brighton Museum and Art Gallery and the Munch Museum are available online at the Mixed Reality Storytelling website[1].

Description

Gift Viz in intended to enable those who developed and deployed the Gift app to inspect the data captured from its use so as to reflect on how it is experienced with possible implications for future development, deployment and possible also the physical and digital curation of museum collections. It is an exploratory tool, generating a range of visualisations, including both static charts and interactive visualisations which the intention of showing the kinds of uses that to which logged data might be put. We foresee several potential audiences for this kind of tool in the future: technology developers who can employ them to identify key break points in the user experience or alternatively, key behaviours that might be further supported and scaled up; museums deploying the app who can identify potential breakpoints in their local deployment, popular gift exhibits (with implications for where these are located in the museum or prioritised for being made available in online digital collections); and researchers who can benefit from new insights into visitor behaviour that can reinforce conventional observations and interviews.

The tool currently generates three different kinds of visualisations that reveal different aspects of usage of the Gift app.

Experience progress charts
The first style of chart shows what proportions of people who use the app progress through the different stages of the gift giving workflow. In other words, it shows how many users drop out of using the app at each key touch point of the experience. This is useful for identifying key weaknesses in the overall app or ways in which it is deployed in a particular museum (e.g., are there some aspects of operation that require greater scaffolding from museum staff). It also sets use benchmark as to expected behaviour with the app which might help museums plan deployments and likely uptakes in future deployments.

[1] http://www.mixedrealitystorytelling.net/gift-viz/

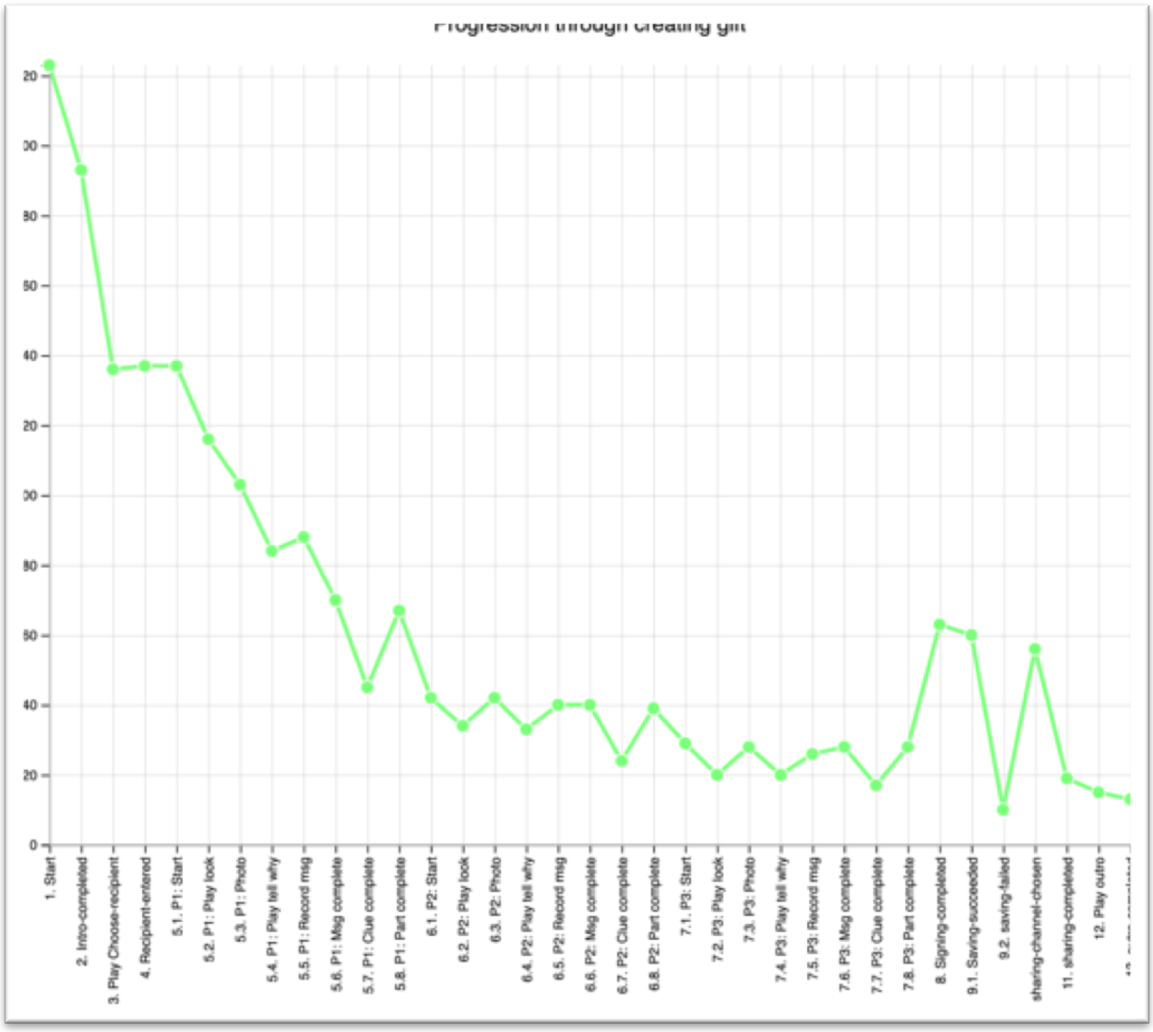

Figure 32. Example of visualising progression through the app (From Brighton museum data) showing the drop in the proportion of use at each stage of the gifting workflow.

A further chart shows the differences in time spent creating gifts between (i) those that were never sent (ii) those that were sent but not opened and (iii) those that were sent and opened.

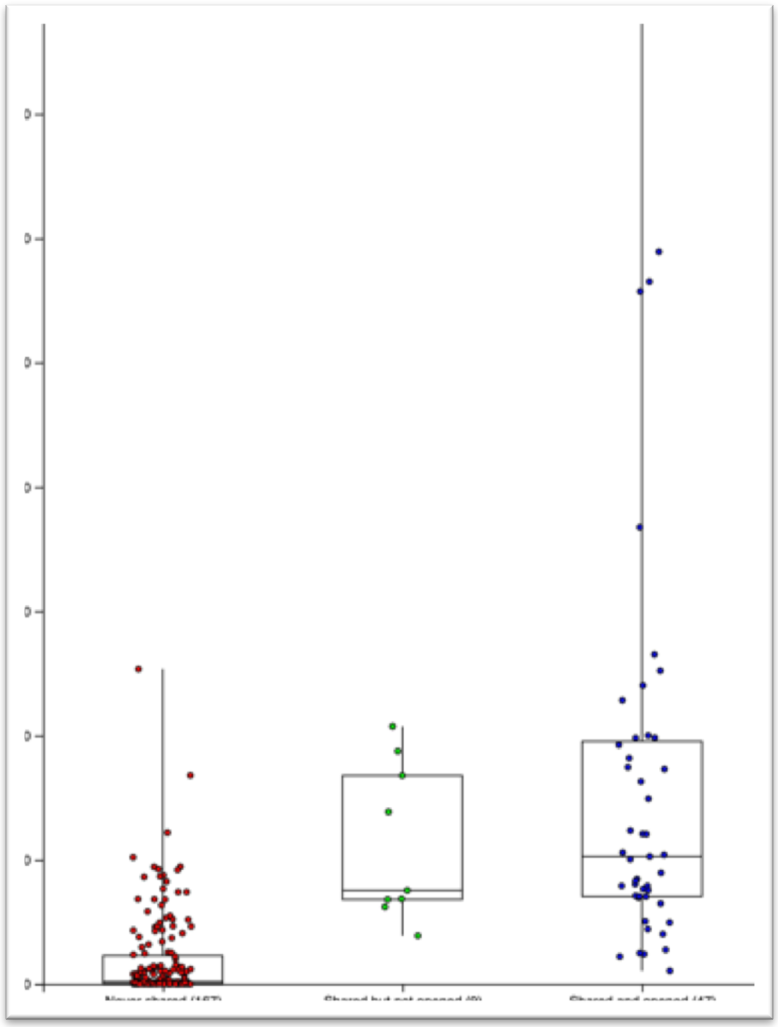

Figure 33. Time spent creating gifts (Brighton Museum data)

Popularity and location maps

Our second kind of visualisation shows the relative popularity of the museum exhibits that were chosen of gifts, overlaid on a map of the museum. Generating this currently requires further human processing of the data to map the photographs taken by visitors when using the app onto actual exhibits within the museum. This is currently a non-trivial task as images may be taken from unusual angles or in quirky ways that make it difficult to identify an exhibit correctly, and so required a good knowledge of the collection and a degree of interpretation of the intention behind the image. Moreover, as we shall see below, a good many gifts involve photos of non-museum exhibits, for example selfies or images or other interesting features of the local environment. Future work might explore whether this currently manual process could be more automated, for example through the application of image recognition techniques or use of location-based services to tag photos in the museum. There is also the potential for using the photos captured from the Gift app as training data for other apps, for example for the image recognition system used in the One Minute app above. The following figure shows examples of the map-visualisations from both The Brighton and Munch deployments.

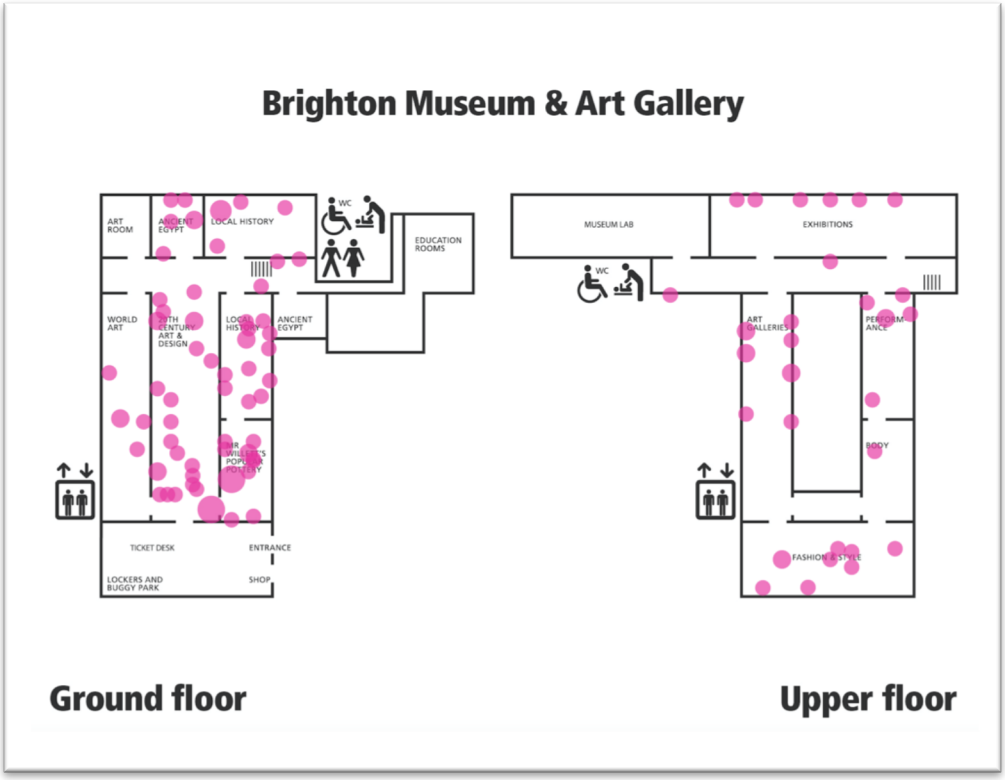

Figure 34. Map showing the popularity of chosen exhibits for gifting at Brighton Museum and Art Gallery

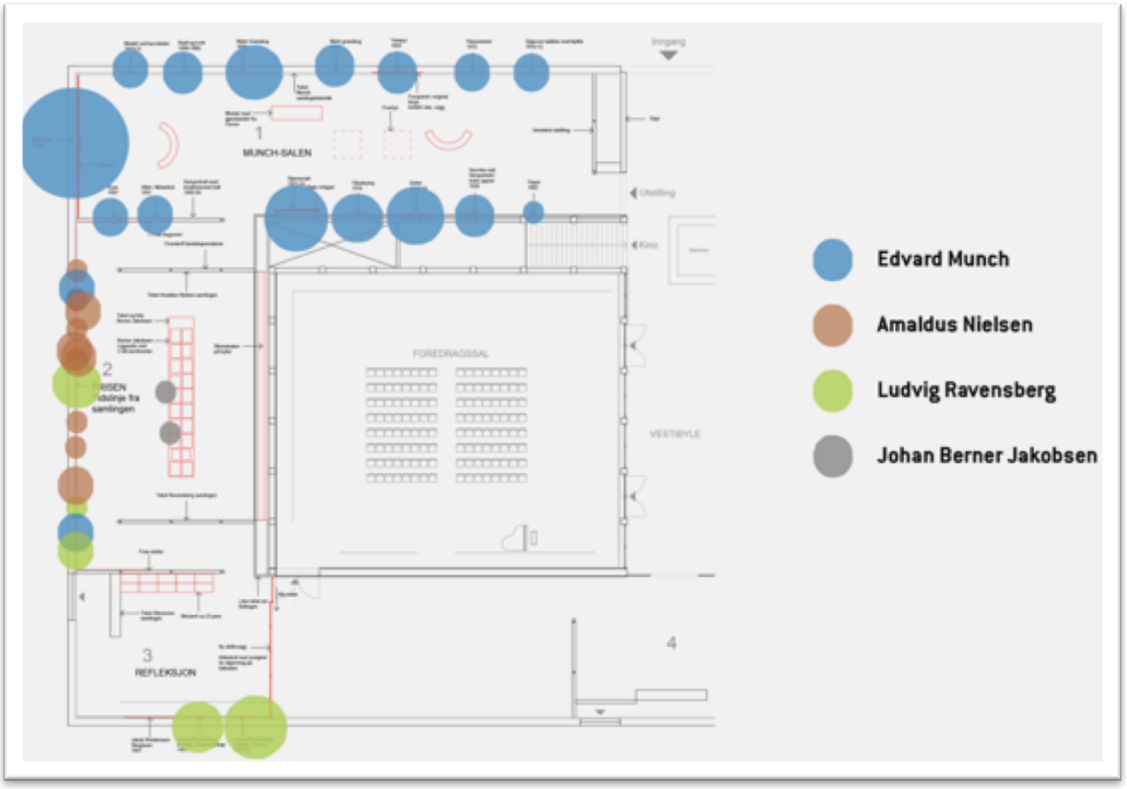

Figure 35. Map showing the popularity of chosen exhibits for gifting at the Munch Museum

Gift giving networks

Our third and final as an extended form of social network graph. The visualisation generates network-style visualisations of gift giving between people, showing who gave which object to who. Technically, the visualisations show which devices generated and opened gifts, which is an approximation for people as there is the possibility that some people used multiple devices, or some devices were shared among people. Both giving and receiving devices are represented as nodes in the graphs (pink nodes in the examples below). The things that they give are also represented as nodes (green below). Links from devices to things show whenever the former included the latter in a gift. Links from things to people show whenever the latter opened the former as part of viewing a gift. Each gift transaction (which might include up to three objects) is shown using a distinct colour. The result is delivered as a zoomable visualisation using the Gephi visualisation tool. The following is an example from the Brighton data.

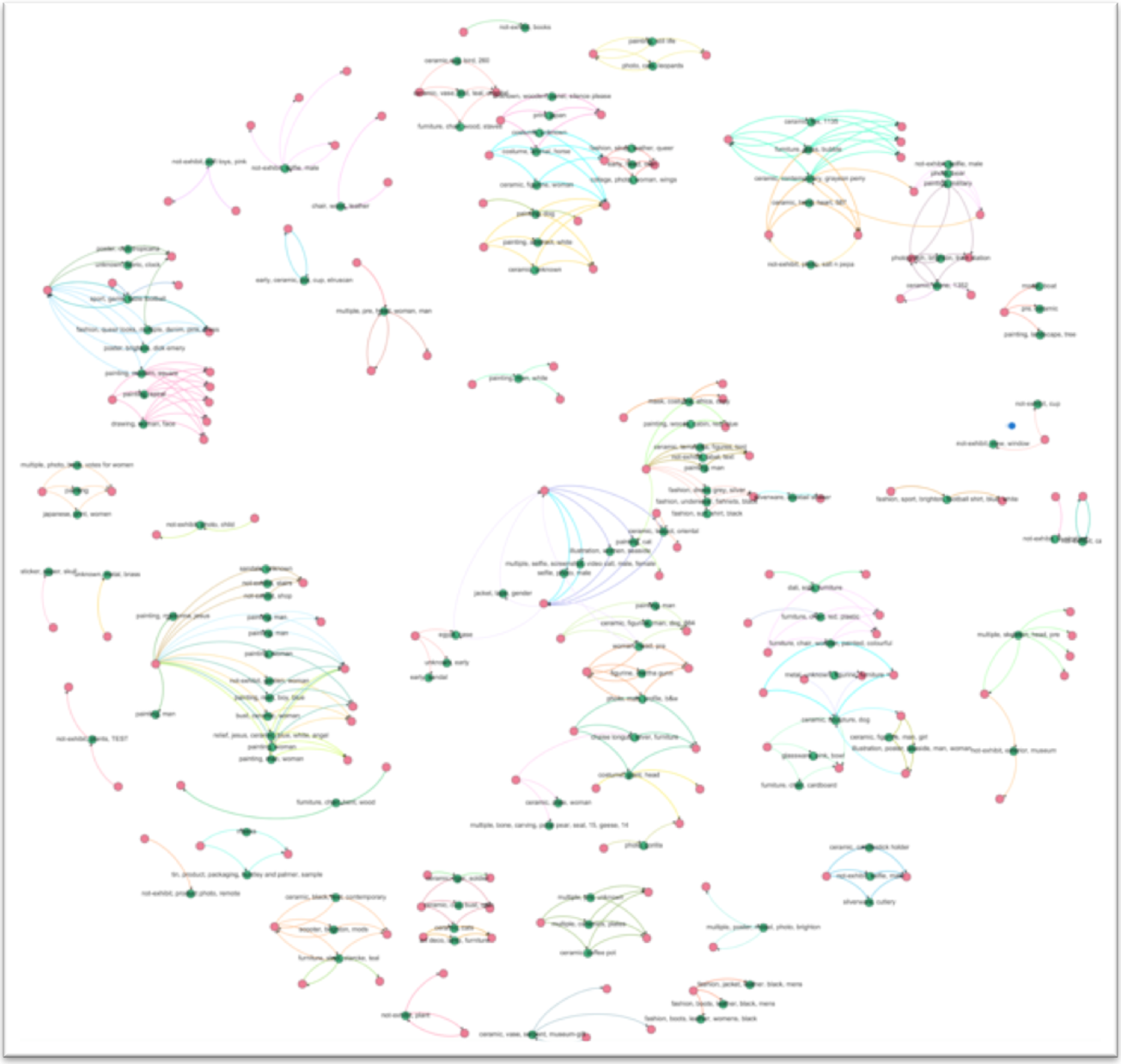

Figure 36. Overview of the entire dataset from the Brighton Museum deployment as a Network Graph

Zooming in on and inspecting this visualisation revealed several kinds of gift behaviour, some examples of which are shown below.

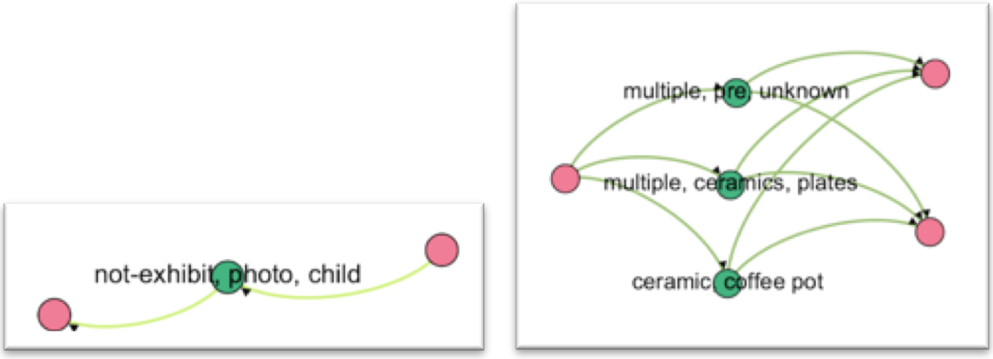

Figure 37. Simple single object gifts (left) versus compound gifts (right)

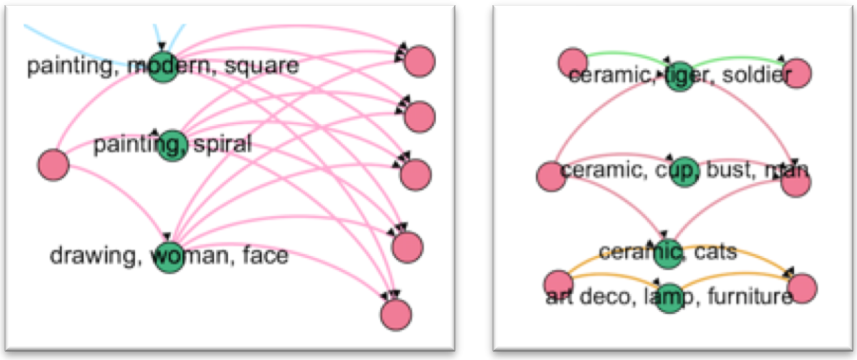

Figure 38. (Left) Giving the same gift to many people
(Right)sharing objects between gifts

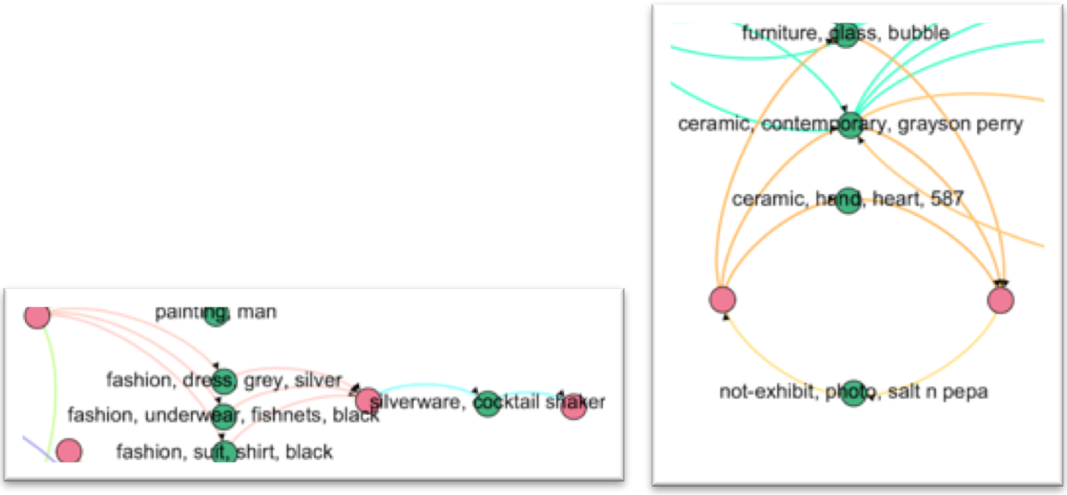

Figure 39. (Left) Chaining – someone receives and gift from one person and gives to another
(Right) reciprocation – two people give gifts to one another

Deployment: Brighton Museum and Art Gallery and the Munch Museum

The tool has been used so far to analyse data from both the Brighton deployments, details of which can be found in Deliverable D2.6 (including the above images and others with fuller descriptions of their meanings). This has also allowed for some direct comparisons between the two datasets, for example the following chart that overlays progress through the two different deployments.

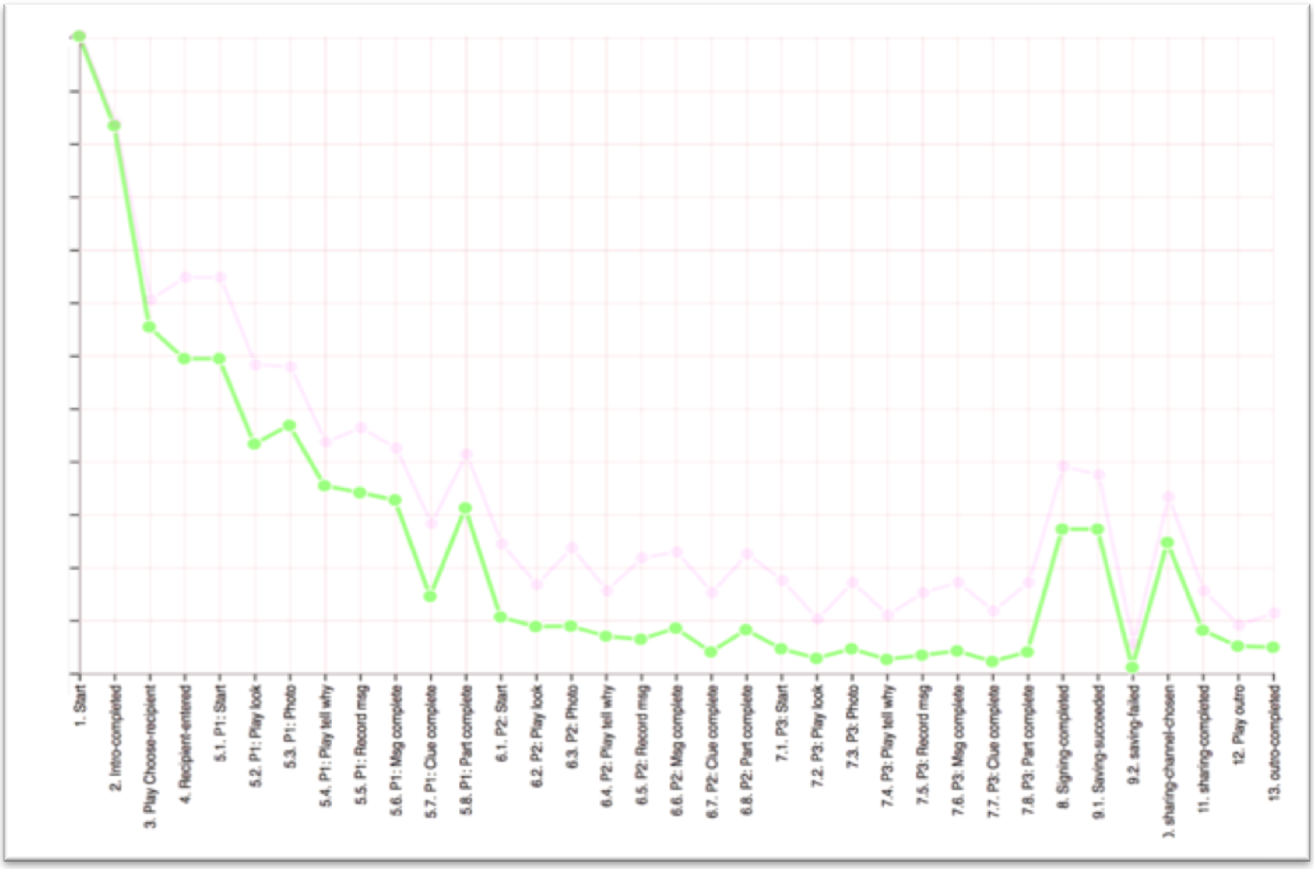

Figure 40. Chart with the two Brighton deployment datasets overlaid for comparison.

The GIFT Platform and Schema

The GIFT platform and schema is ready-to-use implementation of a WordPress-based Content Management System (CMS) plugin and API, and a suggested Data Schema for developers aiming to create mobile and web applications focusing on gifting and has been presented in detail in earlier deliverables. We summarise it here for completeness. While potentially useful for guiding the scalable implementation and roll-out of future tools, work within the project has tended to focus largely on the development of new tools and practical use within museums rather than integration of all tools and data with a common backend, not least because the ideal choice of such a backend remains unclear at this stage.

Status
The platform and schema are offered as a starting template for developers in need of a management backend, database mechanism and initial schema to build upon. They are documented[1] on a dedicated website with the source code available on GitHub[12].

Description
At the core of the GIFT platform is the Schema. This is a JSON-based schema that draws on the industry-recognised WordPress data model to define a generic and extensible description of a gift-like object for the purposes of storage and communication between compatible applications.

In short, the Schema defines the following Gift object:

Gift Object
- Title & Metadata
  - Unique ID and metada for the gift, such as creation dates, etc.
- Gift Giver
  - The stated gift creator and sender
- Gift Recipient
  - The intended recipient of the gift
- Gift Card
  - The initial information that the gift receiver is preented with
- Wraps
  - The applicaiton-specific actions a receiver has to do in order to access the gift content
- Payload
  - The actual content of the gift

The schema is designed to give a starting point for developers, and to be as extensible and flexible as possible. Elements such as the ‘Gift Card’ can describe the text message a gift receiver sees prior to opening their gift, or it can be an elaborate multimedia message driven by data from previous gift exchanges. Similarly the ‘Gift Wraps’ can be used to describe actions as simple as clicking on a ‘Open Gift’ button on the gift receivers device, or as complicated as a personalised interactive treasure hunt and quiz to ‘unlock’ the gift.

[1] https://toolkit.gifting.digital/gift-platform/
[2] https://github.com/growlingfish/giftplatform-schema

The platform and API are WordPress plugins that utilise the post-based structure of the industry leading CMS platform to define custom post types for the elements defined by the GIFT Schema. In this way the interface and paradigms of WordPress, whose wide adoption and popularity introduces a considerable familiarity factor, can be leveraged to perform the complex tasks of managing and curating the database of gifts.

Conclusion

D6.4 rounds off the collection of tools developed throughout the GIFT project, along with a number of use cases demonstrating how they were actioned in gifting or gift-inspired interventions for museums, art galleries, and cultural heritage institutions across Europe.

Broadly speaking our tools fall into three camps:

- A collection of tools to create mobile visitor experiences. These are often technically quite lightweight – being readily deployable on standard smart phones - without the need for other infrastructure to be put in place. However, we suggest that they are experientially novel, enabling museums to engage with new playful and social experience formats.
- A collection of tools that are more focused on digitally augmenting exhibits, including photogrammetry to capture digital versions, 'superimposed' virtual reality to overlay these on physical props, and ways of digital wrapping physical things in digital media. These are more technically complex, but we hope still sufficiently lightweight that museums can easily adopt them for prototyping.
- A third collection of tools to help reflect on the data captured from digital experiences. This has been perhaps the most unanticipated development in the project and while these tools are very early prototypes, we believe that offer a promising avenue for future research and impact.

Our iterative approach has established a pipeline from which tools have continued to emerge throughout the project. We have striven to release the tools in appropriate forms so that external parties can try them out, from webapps to freely available apps on iTunes and Google Play, to documented toolchains and 'taster' visualisations.

Many of the tools have benefitted greatly from input from our ARM partners in WP4. Project researchers and museum partners alike have built, and built upon, these tools, not only to fulfil the stated aims of the GIFT project but to advance the studies of several PhD researchers across all three academic institutions, to generate follow-on research projects with their own funding streams, and to create and/or strengthen relationships with cultural heritage institutions.

Looking beyond the end of the project towards future work, we highlight some key themes for future work:

Inter-personalised experiences – tools such as Gift and Never Let Me Go focuses on reconfiguring relationships between pairs, and potentially groups, of visitors through their engagement with museum exhibits rather than directly addressing their interactions with the exhibits. A key feature of these approaches is that visitors inter-personalise experiences for each other. A notable feature of both tools is that they are technically lightweight, deliberately avoiding complex infrastructures such as positioning and augmented reality technologies that might be barriers to widespread adoption in many museums. Rather they seek to help create new kinds of social museum experience through webapps that can be easily accessed on conventional smartphones by visitors themselves. We believe that this approach to inter-personalisation is highly promising and is worthy of further exploration.

Hybrid wrapping – several of our tools (Artcodes, Gift Wrapper and VRtefacts) support different ways of layering digital media over physical artefacts and point towards a more generalised notion

of ‘hybrid wrapping’ (the theme of a research paper that is under peer review at the time of writing this deliverable). We see great potential in exploring this idea in applications beyond museums, for example in gifting a wider range of experiential products such as other forms of entertainment, music and also food and consumer goods. In parallel, tools such as Scanner Box allows for rapid digitisation of physical artefacts that can then also feed into such wrapped experiences, for example the models subsequently used in VRtefacts.

Data-driven museum experiences – while clearly early explorations, our visualisations suggest the potential for a more data-driven approach to designing museum experiences, including reflecting data back to visitors themselves as part of their experiences. Further work is required to gather larger and richer datasets and refine and validate the approach and supporting tools.

Platforms and schema – the idea of there potentially being a common platform and schema has run throughout the project. However, the need to rapidly innovate new tools and try them out in practice in different partners has led to a relatively diverse set of implementations. Future work by any partner looking to roll these tools out at scale would need to address ‘back end’ platform issues and refine the schema to be able to exchange data and metadata, including for import into visualisations.

Responsible use of data – finally the use of visitors’ personal data in these ways raises the question of responsibility. It is important that the app developers, museums and researchers use data in fair and transparent ways. As a minimum, this means that data should be managed in a way that is compliant with GDPR and other relevel legislation. However, as trust brands, museums need to tread the line between wanting to know about visitors’ behaviours and respecting their privacy. Where exactly this line falls is a matter for further research, including engaging visitors themselves about appropriate uses of their data. In our research so far within the project as have taken the view that a reasonable starting point if to work with anonymised data about patterns of behaviour such as that above where it does not run the risk of revealing visitors’ identities or personal details. This means that we have excluded presenting their personal photographs or analysing and presenting details of the personal stories they tell – fascinating as these would no doubt be. In other words, our current line is that visitors’ photographs and voice recordings are their private data, which descriptions that they made such things (provided they are anonymised) are reasonable data for us to analyse and visualise. As a further note, all of the research presented here has been subject to ethical approval by the University of Nottingham.